SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

FRIDAY, MARCH 26, 1909

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THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE REGULATION OF PHYSICAL INSTRUCTION IN SCHOOLS AND COLLEGES FROM THE STANDPOINT OF HYGIENE[1]

THE researches of modern physiologists on the growth of the brain and nervous system have done more to place the physical instruction of the young on a sound and logical basis than any other influence that can be named, for the specialization of the child's muscular system progresses with the increasing complexity of the brain, and the evolution of his physical nature is but an epitome of the evolution of the whole race.

The infant is born with but two definite voluntary movements, sucking and grasping, necessary for self preservation; all others consist of aimless waving and kicking of the arms and legs and it is not until the assumption of the upright position that the specialization begins that advances him above his four-footed fellows.

Relieved of their function of support, the arms rapidly learn movements of throwing and striking, grasping and pulling, and he familiarizes himself quickly with his surroundings and soon begins the imitation of the movements in animals and people and machines that are within his range of observation.

[1] An address delivered in a symposium on "The Regulation of Physical Instruction in Schools and Colleges, from the Standpoint of Hygiene" before Section K (Physiology and Experimental Medicine) of the American Association for the Advancement of Science, Baltimore, December 20, 1908.

This goes on with increasing freedom. He learns to handle hammers; to cut with a knife; to throw and catch and strike; to explore and hunt; to run and climb.

At the age of twelve the second great change takes place in his evolution. He finds that he is part of a community and begins to take interest in games involving organization. He becomes one of a gang or team, and this involves cooperation, self-sacrifice and discipline—qualities that he does not recognize before this stage.

A band of savages who have organized to fight under a chief instead of every man by his own hand have arrived at the same stage of evolution as Anglo-Saxon boys of twelve to fourteen, as has been so well pointed out by Gulick.

A rational system of physical instruction must follow this evolution if it is to be hygienic or successful, and this was done with preeminent success by Froebel in the kindergarten, where the games and exercises are designed to imitate the hopping of birds, the flying of bees, the circling arms of the wind-mill—objects familiar to the child and appealing to his awakening imagination.

With his increasing age the child is promoted to the lower grades of the public school where space becomes valuable and his freedom is curtailed by the limitations of the school room. The normal occupation of a child is play, but school life means periods of fixed posture and the first application of the hand of discipline to prepare him for community life.

Corrective exercises to overcome the evil tendencies of prolonged sitting when writing and reading must now be introduced, and the time for free play is curtailed.

The well-rounded course would contain these corrective exercises given at frequent intervals throughout the day; class exercises and marching for discipline; and the plays and games that children of that age have always played, modified in some cases to fit the limitations of time and space imposed by the school hours and the play ground.

At about sixteen there is a break in the youth's education. Most children finish their formal studies and go into their life's work. A few go on to college; but the freshman class of a college is also made up of young men recruited from the farm, the shop, the office, the factory and the night school, presenting all the mental and moral defects of these widely varying occupations. Many of them have uncorrected eye defects; round or crooked backs; narrow, flat chests and flabby muscles. The play instinct may have been crushed out by the hard grinding life of the factory, or office, and they may have lost the knowledge and desire to play. They are old before their time. In contrast to those are the undisciplined and self-sufficient athletic men, who do not take kindly to the discipline of college life, considering it as an unnecessary evil to be avoided as much as possible.

A careful physical examination should precede any attempt to provide physical instruction for college students.

This examination should include data on family history; habits of life; health history, obtained by leading questions which may be followed up if necessary; tests of simple maximum effort in the movements most frequently employed, extension of the back and legs, flexion and extension of the arms, the grasping power and lung capacity, with a certain number of measurements for purposes of comparison.

The students may then be divided into three classes: (1) Defective, (2) average and (3) athletes.

Defectives need personal advice and individual prescription to correct flat foot, uneven shoulders, constipation, hernia,

obesity, old heart lesions or joint injuries. These are given on cards and the student taken over each exercise in detail by an instructor who reports at frequent intervals.

The average man may be taken in classes which should begin by exercises of discipline, marching and setting-up movements to word of command. They should then be examined to find their ability to perform certain exercises of skill, and classified according to their proficiency. A course of graded exercises should follow, closing with a re-examination. This procedure may be repeated three or four times during the college year.

In designing the exercise to be given to the college student, the evolution of the race must be kept in mind and the old co-ordinations that have been responsible for its development must be used as much as possible in a natural manner.

1. *Locomotion:* in marching, running, jumping, dancing, tumbling, climbing and swimming.

2. Throwing large and small balls for distance and accuracy. Catching and dodging.

3. *Fighting:* by striking, as in boxing; by grappling, as in wrestling; by thrusting, as in fencing; and by striking, as in single stick or saber.

Some of these are best taught indoors, but where it is possible all exercises should be taken in the open air.

All the most popular athletic contests can be arranged to apply to the general mass of the students by setting a low standard, by having the whole class try a feat at once, by doing the exercise to word of command, and by stopping short of great fatigue.

After a certain time there is a tendency to specialize in those who find the general class work too easy, and this may be found on entrance to college in some whose preliminary training has been obtained in preparatory schools. They naturally drift into competitive athletics, but this involves an entirely different kind of training from that already described.

The distinction between physical training and athletic training must be sharply defined.

In physical training the object is to bring the standard of health up to its highest level, and all excessive strain or exhaustion is avoided while all the activities are exercised.

In athletic training the object is to bring the human machine to its highest point of efficiency to perform a definite feat, and everything that is useless or detrimental is sacrificed. The heart is made larger and stronger than is necessary for ordinary life if the feat to be performed is one of endurance. The nervous system is made irritable and alert if speed is required, the special muscles are developed, and the normal store of fat is lessened if agility is the necessary requirement. The object is not primarily health but superlative ability, either in strength, speed or endurance, and the undue absorption of fat leaves the constitution less able to withstand the siege of a constitutional infection like typhoid fever or pneumonia in which a moderate amount of fat is a valuable asset.

In deciding the value or harmfulness of athletic training, however, the physiologist has not always the last word to say. The ethical and social sides assume here an importance that overshadows the purely physiological consideration. The athletic class will never exceed ten or fifteen per cent. of a college community, and it is after all for the main body of students whose interests are not primarily athletic that physical instruction must be considered and its details planned so that they may be enabled to graduate stronger,

sounder, more self reliant and more efficient.

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ON THE PHYSIOLOGICAL EFFECTS OF MODERATE MUSCULAR ACTIVITY AND OF STRAIN[1]

Practical efforts, both in Europe and America, to solve the problem of physical training in schools and colleges have proceeded along two different lines, which are roughly typified in Europe by the English system, on the one hand, and the Swedish and German systems, on the other. In the former, athletic efforts may be said to play a predominant rôle; in the latter, they are strictly subordinated in the endeavor to reach the masses. Similarly, the practise in America differs considerably. In some colleges the great stress is laid upon athletics; in others athletic activities are entirely separate from instruction in physical training for the student body as a whole. But these are the extremes, for in the majority of cases the organization of the work combines, or seeks to combine, both. Perhaps it will be conducive to clearer thinking if we define at the outset the difference between the two extremes.

In those cases where athletics are under separate organization and control, it is the aim of the department of physical training to secure for each individual student the proper basis of health for his work in school or college and also to educate him in the truest sense of that word for the proper hygienic conduct of his subsequent life. Physical training is not regarded as an end in itself, but as an essential means toward the equipment of the individual for the work in which he may engage. The effort is, furthermore, made to do this economically as regards both time and effort. The athletic ideal is entirely different. It does constitute at the time an end in itself; its primary purpose is not the cultivation of health, but of excelling some one else. It brings into play the elements of competition and championship. The athletic team of a school or college represents the best which the institution can do in that line of effort. Sacrifices of time, of convenience, and, generally, to some extent at least, of scholarship, are regarded as proper, if needed to secure the immediate end in view. Physical risks must be taken if necessary, risks which may end in permanent injury, and even in death, in order that one's college shall prove itself superior to some other college.

There are thus, these two ideals which come into practical work of physical training. It is of course not necessary that we adopt one to the exclusion of the other; but these ideals profoundly influence the practical measures adopted, and it is essential that we approach the solution of our problem from the right point of view. It should be added that, in giving each its due weight, other considerations than the strictly hygienic must enter into our decision. First, there is the question whether a given plan of action reaches the masses and is effective with them from the standpoint of physical training; and there is also the question whether we do not need to cultivate those moral qualities of group loyalty, of subordination of self to the interest of the whole, and of the willingness to make the supreme effort for a common cause, which is perhaps the very soul of modern school and college athletics. These are questions on which obviously the physiologist has not the last word,

[1] An address delivered in a symposium on "The Regulation of Physical Instruction in Schools and Colleges, from the Standpoint of Hygiene" before Section K (Physiology and Experimental Medicine) of the American Association for the Advancement of Science, Baltimore, December 20, 1908.

although he must have an important share in their answer.

Returning to the strictly hygienic side of the question, I am simply trying to get clear in your minds the fact that there are these two ideals and that one of them involves the necessity of training for and, at times, the making of a supreme physical effort on the part of the contestant. The other does not involve this element; on the contrary, perhaps it generally seeks to avoid it, thus leaving the individual free to concentrate his effort on some other object.

Now, whether we attempt or do not attempt to include these elements of moral education in our efforts at physical training, it is of first importance that we secure the hygienic ends and that our work be successful with the masses and not solely with those who finally engage in athletic contests. Not only this, but, viewing physical training as a part of education as a whole, it is even fair to demand of it that it do more than provide the physical capital for the work of life by securing the proper development of the body during the period of youth; it should also lay the foundation of correct habits; it should leave the student with the ability to enjoy those forms of physical activity which are possible amid the more serious concerns of adult life, and with a compelling belief in the necessity, even the obligation, of maintaining the physical man.

With this in mind, let us review rapidly the biological requirements of the human body for muscular activity as an essential factor in health. In this audience, it would be only to state a truism to say that the human frame is constructed for a life of muscular activity; that the fact that, until very recently, mankind has supported itself by physical rather than by mental exertion must have led to the survival of those with bodies adapted to physical exertion. So essential was it that this adaptation should be of a very high order, that we are not surprised to find that it went to the extent of producing a body not only capable of sustaining, but even of profiting by, physical exertion.

Assuming that this adaptation of the organism for muscular activity is the result of a hard process of natural selection, we should expect to find that the extent of the adaptation is determined by its survival value; that is to say, it would not be reasonable to expect adaptation of the race as a whole to degrees or forms of muscular exertion which formed no part of the daily life of the average man or woman, and we may assume to-day that the race as a whole is not likely to profit by forms of activity distinctly more strenuous than those to which it has been accustomed in the past.

"The muscular activity which thus formed part of the life of our ancestors may be described as generally moderate, though at times it was vigorous or hard; only exceptionally did it involve extreme endurance or great muscular strain. . . . Where work of this kind had to be done it was left to those who, by reason of exceptional strength, were especially fitted for it."[2] It would seem that it is to such work that the race, as a whole, is adapted and there is thus a strong *a priori* theoretical probability that it is by such work that it is most benefited. In using the term "moderate muscular activity" in this discussion, you will understand that I am referring to work of this kind. And it is sufficiently obvious that the training for beating a record, or for rowing, or football is something distinctly in excess of this.

Through what physiological channels

[2] Hough and Sedgwick, "The Human Mechanism," p. 312.

does this moderate muscular activity minister to the health of the body? We can not discuss this at any length here, and to do so would only be to repeat what has been explained over and over again. But we may mention the following as the principal hygienic effects.

1. Muscular activity affords training to the heart, so that it is not only equal to the emergencies of life, but is also able to withstand the fatigue of moderate prolonged exertion. No exercise can be enjoyed unless this fundamental condition is satisfied.

2. Muscular activity relieves vascular congestions in the internal organs by bringing larger quantities of blood to the skin. In doing this it improves the physiological condition of the skin, as well as that of deeper organs.

3. As a result of the deepened and frequently quickened respiration all lobes of the lungs are used and the apical lobes rendered less liable to the attacks of disease.

4. As a further result of the increased breathing movements, as well as of the pumping action of contracting muscles and movements at joints, the flow of lymph along the lymphatics is greatly favored, and this improves the environmental condition of all cells of the body.

5. Muscular activity also affords important training to the heat-regulating mechanism of the body.

6. Muscular activity exerts a favorable influence upon the digestive processes, promoting proper secretion and absorption and tending to prevent the unhealthful conditions leading to constipation.

7. Muscular activity is conducive to refreshing slumber. This is partly because of the maintenance of normal conditions in the body generally and probably, in part, because it is conducive to the healthful fatigue which facilitates the normal relaxation from nervous strain. Whatever may be the physiological explanation of the phenomenon, there can be no question of its existence and of its hygienic value to the nervous system.

It is not essential to our purpose that we make a complete list of these favorable physiological effects. Probably the above comprises the more important of them, and before leaving this part of our subject we may point out two things. First: these are all hygienic essentials and most, if not all, of them can be properly secured only by muscular activity. The training of the heart, the maintenance of deepened breathing without depriving the blood of its due charge of carbon dioxide, the favorable effect on the flow of lymph—for it is an old physiological observation that there is no lymph flow from the limbs when motionless—the favorable effects on digestive functions and on slumber, all of these can be secured in *no other way* than by muscular activity. This means that physical training is an essential in any properly planned course of education and that no school or college is justified on any ground whatsoever in failing to provide properly for this need of its students. Second: all these hygienic effects can be secured by what we have termed "moderate" exercise. Not one of them requires the effort involved in training for athletic events. This fact seems to me to justify a statement which I have made elsewhere to the effect that "the athletic ideal is not the hygienic ideal; it may not be unhygienic, but it is not required for purposes of health."

But athletic training and athletic contests may be at least desirable and possibly necessary for other than hygienic purposes; and so the question at once presents itself whether in using it for these purposes unjustifiable risks to health are

taken. What are the physiological effects of the training for and the participation in such efforts?

The contribution of the physiologist to the answer to this question must be limited to a statement of what is known of the physiological conditions during strain. It is for the clinician to tell us how far these dangers actually produce ill effects; and the clinical evidence, to be at all satisfactory, must be drawn, not simply from the study of cases which apply for treatment, but from a systematic study of an entire group of *average* people participating in such work. For it must be remembered that the appeal of athletics is not simply to those who will finally make a school or college team, but to a much larger proportion of the student body.

First, I think we should make sure that we appreciate the weight of the burden of physiological adjustment which muscular activity places upon the organism, for this is always greater than is generally supposed. It may be measured with a fair degree of accuracy by the respiratory exchange, since this varies almost *pari passu* with the work. The comparison must, however, be made between the expired air, collected directly from the respiratory passages, during rest and during the actual performance of work. Measurements made in respiration chambers, unless the work extends over several hours (and very severe work can not be maintained continuously for this length of time), necessarily involve some lag in the collection of the samples. I will quote from two reliable observations involving such direct analyses of the expired air.

Leo Zuntz[3] found that the oxygen consumed per minute while riding a bicycle on a level asphalt track at a speed of nine miles an hour increased from 263 c.cm. (during rest) to 1,550 c.cm., and that when the speed was increased to thirteen miles an hour it rose to 2,058 c.cm., an increase of eightfold. This corresponds very closely with what Zuntz and Lehmann[4] had previously found for the horse, where the oxygen consumed and the carbon dioxide excreted per minute increased from five to ten fold with moderately heavy to hard work, respectively. All observations, moreover, show that this respiratory need must be met at once, which means an enormous increase of work on the part of the respiratory and vascular systems. When we find the muscular work of the sitting posture almost doubling that of the sleeping condition; even light activity doubling the work of the sitting posture; only moderately heavy work increasing it four or five fold, while vigorous activity increases it eight and ten fold; and when we reflect that all this must be immediately provided for in the successful readjustment of the circulation and respiration—we begin to appreciate the possibilities of physical strain.

Two very different forms of muscular activity introduce into the organism conditions of strain and the nature of the strain in the two cases is very different; first, when a supreme effort is put forth suddenly and for comparatively brief periods of time, as in the hundred yards' dash; and, second, where vigorous but less violent exertion is prolonged over a much greater time, as in long-distance running. Probably the chief dangers in the two cases are, respectively, excessive arterial pressure, at times combined with disturbance of the pumping action of the heart, and fatigue.

With regard to arterial pressure during muscular activity, the reliable data at hand are sufficient to give us an idea of

[3] Leo Zuntz, "Untersuchungen über den Gaswechsel und Energieumsatz des Radfahrers."

[4] Zuntz and Lehmann, "Stoffwechsel des Pferdes," Berlin, 1889.

the possible strain which may at times be placed upon the heart and arteries, but they do not give us the knowledge we should have of the pressure conditions during fatigue. It is clear enough that in the increased output from the heart and the probable constriction of the arterioles of the splanchnic and other internal organs pressor factors are introduced, while in the dilation of muscular and cutaneous arterioles depressor factors are introduced; through the changes of thoracic aspiration and the rhythmic pressures on the bloodvessels of the working muscle and moving joints, arterial pressure must also be influenced, the exact direction of the influence probably differing with the nature of the exercise and the condition of the organism. Finally, where very rapid rhythmic or sustained contractions are made, the blocking of the circulation through the muscles must exert a marked depressor influence. The net result must be the algebraic sum of these pressor and depressor influences and we are prepared to find, as we actually do, considerable variations of result. Thus Zuntz and Hagemann[5] found in the horse a slight fall of mean pressure, but sometimes a slight rise with moderate work. In the dog, on the other hand, Tangl and Zuntz[6] always found a rise of from 20 to 30 mm. of mercury with active exercise; but when the dog was made to run very rapidly in the treadmill so that distinctly labored breathing developed, enormously high mean pressures of 275 mm. of mercury were recorded. In the latter case, the relaxation period of the muscle was probably not long enough to permit the blood to flow through in any quantity, so that the great muscular outlet from the aorta was temporarily blocked off. These direct measurements, however, suffice to show that moderate muscular activity causes only a slight change of mean arterial pressure and that change usually an increase of from 20 to 30 millimeters of mercury; but that certain forms of muscular activity may result in pressures which must be looked upon as distinctly dangerous.

Upon man I would next call attention to Bowen's[7] very careful measurements of systolic pressure, during work on a stationary bicycle, the work being described as "just vigorous enough to satisfy the needs of a healthy man who is not in training for athletics." He found that the systolic pressure rose from 130 mm. of mercury to a maximum of 180 mm. within the first five or ten minutes; after this there was a fall to a plateau of 165 or 170 mm., or even a continuous but gradual fall throughout the thirty-five minutes of the work. After the cessation of the work there was a sudden fall to or even below the normal, followed by a return to normal within ten minutes. Those interested in the subject will find Bowen's paper very suggestive.

Lastly I should mention McCurdy's[8] measurements of systolic pressure during the maximal effort of the ordinary gymnasium test of strength of legs. The pressure was first raised in the brachial armlet to 500 mm. of mercury, or thereabouts, and then rapidly lowered during the effort until the radial pulse could be felt. This method would give somewhat low records for systolic brachial pressure, but even then pressures of from 175 to 265 mm. of mercury were recorded. The form of effort reproduced the conditions of

[5] Zuntz and Hagemann, "Stoffwechsel des Pferdes," 387 foll, Berlin, 1898.

[6] Tangl and Zuntz, *Pflüger's Archiv*, LXX., 554, 1898.

[7] Bowen, *American Journal of Physiology*, XI., 59, 1904.

[8] McCurdy, *American Journal of Physiology*, V., 95, 1901.

forced expiration with closed glottis and it was found that this act alone (without the lifting) caused a similar rise. I can confirm this statement from experiments made in my own laboratory.

These facts are enough to show the extent to which certain forms of muscular activity may raise arterial pressure and we can not but regard this condition, even in the young, as a source of danger. The risk of cardiac dilatation, valvular insufficiency and injury to the arterial wall have been frequently pointed out, and it does not seem that the need for the utmost caution is put aside by the argument that investigation fails to show bad effects on health among those who have engaged in athletic contests in the past. Meylan's[9] very careful and satisfactory study of the Harvard oarsmen from 1852 to 1892, inclusive, undoubtedly shows marked freedom of these men from cardiac or other vascular troubles in later life, and force the conclusion that this most vigorous of athletic trainings is consistent with the subsequent good health of those who "make the crews." But these are the picked men, physically, of the university and the facts only show that with proper training and under proper medical supervision these picked men may engage in such work without harmful after-effects. But it is one thing to supply adequate medical supervision to a team or crew, and quite a different thing to supply it to a large student body engaging in athletic training; for no medical supervision can be regarded as adequate unless it detects the signs of mischief before it has gone beyond the possibility of repair. In the absence of such supervision it is simply common every-day prudence to keep physical effort well within the bounds of safety. The best gymnasium instructors watch carefully for signs of strain, such as skin pallor, labored breathing and the like, during a run and diminish at once the intensity of the work. And in doing so they are only putting into practise the hygienic principle which we have already drawn from the consideration of the probable extent of adaptation of the race as a whole to muscular activity. The average man or woman, the average boy or girl, is not adapted for extreme effort, and it is not proved by experiment or experience that, in such cases, training can supply what heredity has failed to furnish.

Passing to the second condition of strain imposed upon the organism by athletic activities, that of vigorous but not supreme effort continued over longer periods of time, I shall cite only the observations[10] made for three years upon contestants in the Marathon Race held annually under the auspices of the Boston Athletic Association. These show that at the close of the twenty-four mile race (two and one half to three hours) there was always an enlargement of the heart with a systolic murmur (which, however, Larrabee hesitates to attribute to mitral incompetence), that all the signs pointed toward lowered mean blood-pressure; that the blood counts showed "a leucocytosis corresponding in intensity and type with that observed in various inflammatory diseases"; and that the urine invariably contained traces of albumin and more or less blood.

This presents to us the picture of the organism struggling with the conditions of marked general fatigue, especially in the working of the heart and of the vasomotor mechanism. The circulation is being maintained under extremely unfavorable conditions and presents every sign of venous congestion with its resulting inter-

[9] Meylan, "Harvard University Oarsmen," *Harvard Graduates' Magazine* and *American Physical Education Review*, March and June, 1904.

[10] Blake, Larrabee and others, *Boston Medical and Surgical Journal*, CLXVIII., 195, 1903.

ference in the work of the kidneys. It should also be pointed out that even though arterial pressure is subnormal, yet a weakened heart working against comparatively low pressure may be in as great danger as a strong and fresh heart working against high pressure. The conditions may, it is true, be only transitory; they may pass away without lasting ill effects; but they are all distinctly unfavorable conditions in the organism, and we are not justified in looking upon them as other than warnings which must be heeded in formulating proper systems of physical training for the masses.

It is, of course, easy to exaggerate these dangers and it is difficult even to state them clearly and fairly without running the risk of being misunderstood. I should be the last man in the world to advocate the banishment of athletic activities from college life. I would not be understood to discourage new forms of physical exercise merely because they are new and have not formed part of the ancestral activities to which the adaptation of the organism is most perfect. I believe in the active life, in the cultivation of greater physical strength and endurance with all classes and all ages; but let us do this with full understanding of the risks involved, always with due reference to securing in each individual the maximal efficiency in subsequent life, and above all with the determination to provide for the masses the best possible physical training.

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CURRENT PROGRESS IN CONSERVATION WORK

THE Proceedings of the Conference of Governors on the conservation of the natural resources of the country, held in the White House, Washington, May 13–15, 1908, have just been issued in a volume of xxxv + 451 pages. The bulk of the edition is distributed by senators and representatives; the smaller portion designed for distribution by the President among the governors and other conferees is in course of distribution under the direction of ex-President Roosevelt by the Joint Committee on Conservation (Hon. Gifford Pinchot, chairman).

The National Conservation Commission, appointed by the President on June 8 last pursuant to action at the Governors' Conference, held a working session during the first week in December last, at which an inventory of the resources of the country was discussed and a report adopted; during the second week in December the inventory and report were considered at the Joint Conference of State and National commissions and commissions or committees appointed by national organizations. The Joint Conference approved and supplemented the papers, which were duly submitted to the President and were by him in January transmitted to Congress with an approving message. The inventory is the most complete quantitative statement of natural resources ever prepared for any country. After some delay, publication was authorized by Congress, and the matter is now in type and undergoing proof revision. It will form two volumes, aggregating some 1,700 pages. Provision has not yet been made for adequate distribution.

The complete preliminary Report of the Inland Waterways Commission (which body arranged for the Governors' Conference and the subsequent steps in the conservation movement) has been in the hands of the printer for several months, completion being delayed by extensive proof revision, especially of the extended statistical matter prepared in the office of Hon. Herbert Knox Smith, Commissioner of Corporations. The matter is now on

the press, and will be issued within a few days in a volume of vii + 703 pages. The bulk of the edition will be distributed by senators and representatives; a limited number of copies being held for the use of experts.

Pursuant to the Joint Conference in December, President Roosevelt invited Canada and Mexico to join the United States in a joint movement for taking stock of the natural resources of the North American continent. The neighboring nations accepted with alacrity, and each designated three commissioners to meet in Washington with a like number of American commissioners on February 18; and at the instance of the British Ambassador the colony of Newfoundland was also represented. This "North American Conservation Conference" was signally harmonious, and constructive ideas prevailed throughout the deliberations. These continued until February 23, and resulted in the appended *Declaration of Principles.*

A specially noteworthy feature is the unanimous opinion that the time has come for rendering the conservation movement world-wide in scope. When this opinion was submitted to President Roosevelt, he promptly responded by addressing invitations to all civilized nations to join in a conference devoted to consideration of the world's natural resources, to be held at The Hague at such date as may be found generally convenient—if practicable, about September next. Replies (without exception favorable) are arriving in due course; the French government has already taken formal action, and several other nations have announced that action is under way.

During the closing days of the Sixtieth Congress the following amendment was added to the Sundry Civil Bill:

> Sec. 9. That hereafter no part of the public moneys, or of any appropriation heretofore or hereafter made by Congress, shall be used for the payment of compensation or expenses of any commission, council, board, or other similar body, or any members thereof, or for expenses in connection with any work or the results of any work or action of any commission, council, board, or other similar body, unless the creation of the same shall be or shall have been authorized by law; nor shall there be employed by detail, hereafter or heretofore made, or otherwise personal services from any executive department or other government establishment in connection with any such commission, council, board or other similar body.

When the bill was enacted and submitted to the President for signature, he disapproved this item in a memorandum attached to and forming a part of the Act (and which has received wide attention through the press), as follows:

> I have hesitated long before affixing my signature to this bill, and if it were earlier in the session, or if the bill contained a less number of important propositions of benefit to the country, I should certainly not sign it. Moreover, if section 9 of the bill, to which I subsequently refer, were operative according to its evident intent, I should be forced to veto the bill anyhow. But I have concluded that this section is not operative to the extent that its framers evidently hoped, and that the mischief it will cause, though appreciable, can be sufficiently remedied by the action of the Executive to warrant my permitting the bill to become a law, in view of all the considerations surrounding the case.
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> Section 9 of the act contains a provision far more damaging to the interests of the public. This attempts to prohibit the use of any government funds or the detail of any government clerks to help the work of any commission, council or board, unless the same is specifically authorized by previous congressional action. This could certainly only result in hampering efficient government work. But as the purpose of the attempt in its entirety is clearly an invasion of executive prerogative, and unconstitutional and void, it is only very partially successful. The provision is obviously aimed at such commissions or boards as, for instance, the Conservation Commission, the Country Life Commission, the Council of Fine Arts, the General Board of the Navy and the Joint Board of the Army and Navy, not to speak of such boards as the National Advisory Board on Structural Material, the board of reference in

connection with the pure food law and scores of others, none of which were first authorized by Congress, but all of which were called together by the Executive for the purpose of public service; for the purpose of rendering to our people sorely needed service which could not and would not otherwise have been rendered. So far as the various army and navy boards are concerned, the attempt is fortunately futile, and represents merely failure in an effort to subordinate purely military and national considerations to small personal or political considerations. The President has under the Constitution the sole power to direct the use of the officers of the army and navy, always provided he acts within the limits set by the Constitution. The Congress can no more forbid the President to use the services of officers or employees when they act in concert as a board or council than it can forbid him to use their services when they act as individuals.

The chief object of this provision, however, is to prevent the Executive repeating what it has done within the last year in connection with the Conservation Commission and the Country Life Commission. It is for the people of this country to decide whether or not they believe in the work done by the Conservation Commission and by the Country Life Commission. If the people of this country do not believe in the conservation of our natural resources; if they do not believe in developing our waterways and protecting our forests; if they do not believe in the betterment of life on the farm, and in upholding the interests of the farmers; if they are willing to go on in the old course of squandering the effects of our children's children; then they will uphold the action of those in Congress who are responsible for this provision. If they believe in improving our waterways, in preventing the waste of soil, in preserving the forests, in thrifty use of the mineral resources of the country for the nation as a whole rather than merely for private monopolies, in working for the betterment of the condition of the men and women who live on the farms, then they will unstintedly condemn the action of every man who is in any way responsible for inserting this provision, and will support those members of the legislative branch who opposed its adoption. I would not sign the bill at all if I thought the provision entirely effective. But the Congress can not prevent the President from seeking advice. Any future President can do as I have done, and ask disinterested men who desire to serve the people to give this service free to the people through these commissions. This action taken by the Congress hampers and renders more difficult the work of such commissions, and entails a greater sacrifice in time and money upon the public-spirited men who disinterestedly and without any recompense have served or may serve on these commissions. But the Congress can only hamper and render more difficult, it can not stop this work. The Executive can continue to appoint these commissions and can make exactly the use of them that I have made in the past, although, owing to the Congress, a greater burden will be put upon them.

The republican platform last year said: "We endorse the movement inaugurated by the administration for the conservation of natural resources. . . . No obligation of the future is more insistent and none will result in greater blessings to posterity." The democratic platform said: "We repeat the demand for internal development and for the conservation of our natural resources, the enforcement of which Mr. Roosevelt has . . . sought."

My successor, the President-elect, in a letter to the Senate Committee on Appropriations, asked for the continuance and support of the Conservation Commission. The Conservation Commission was appointed at the request of the governors of over forty states, and almost all of these states have since appointed commissions to cooperate with the national commission. Nearly all the great national organizations concerned with natural resources have been heartily cooperating with the commission.

With all these facts before it, the Congress has refused to pass a law to continue and provide for the commission; and it now passes a law with the purpose of preventing the Executive from continuing the commission at all. The Executive, therefore, must now either abandon the work and reject the cooperation of the states, or else must continue the work personally and through executive officers whom he may select for that purpose.

When I speak of the Congress I, of course, mean those members of the Congress who are responsible for this provision of the bill, and I emphatically do not mean those public-spirited members who have striven to prevent the incorporation in the bill of this provision. To the Congressmen who in this and similar matters have stood by the interests of the public, the interests of those whom Abraham Lincoln called "the plain people," the heartiest support is owing. But I call the atten-

tion of those who are responsible for putting in this provision to a fundamental fact which is often ignored in discussing and comparing the action of the executive and the action of the legislative branches of the government. Neither one is responsible to the other. Each must act as its wisdom dictates. But each is responsible to the people as a whole. It is for the people to decide whether they are represented aright by any given servant; and one element in enabling them to reach a decision must be that public servant's record in such a case as this.

At the Joint Conference on Conservation, in December, a resolution was offered providing for a joint committee of nine to prepare a plan of cooperation among conservation commissions, six members to be appointed from state commissions and three from the National Commission; in the course of discussion, provision was made for including also the chairman and secretary of the latter body (Hon. Gifford Pinchot and Mr. Thomas R. Shipp) and in this form the resolution was adopted. The first formal meeting of this joint committee was set for March 5; and on that and the ensuing day the committee met and framed a plan for joint work which will be circulated during the present month. On March 6 several members of the committee, headed by ex-Governor Pardee, of California, and accompanied by Governors Deneen, of Illinois, Willson, of Kentucky, and Quinby, of New Hampshire, submitted the general plan for continuing the conservation work to President Taft, who reiterated his frequently expressed intention of continuing the task begun by his predecessor, and using every effort to secure legislative action. In the course of the meeting of the Joint Committee on Conservation, it was found that thirty-seven states have appointed state conservation commissions, and that some thirty organizations of national character have appointed committees of like character and purpose. Definite arrangements were made for coordinating the work of these organizations in such manner as to yield increasingly accurate inventories of the natural sources of national prosperity and perpetuity. Messrs. Pinchot and Shipp, respectively, were made chairman and secretary of the committee, and headquarters were established in the Wyatt building, Washington, D. C.

W J McGEE

NORTH AMERICAN CONSERVATION CONFERENCE
DECLARATION OF PRINCIPLES

We recognize the mutual interests of the nations which occupy the continent of North America and the dependence of the welfare of each upon its natural resources. We agree that the conservation of these resources is indispensable for the continued prosperity of each nation.

We recognize that the protection of mutual interests related to natural resources by concerted action, without in any way interfering with the authority of each nation within its own sphere, will result in mutual benefits, and tend to draw still closer the bonds of existing good will, confidence and respect. Natural resources are not confined by the boundary lines that separate nations. We agree that no nation acting alone can adequately conserve them, and we recommend the adoption of concurrent measures for conserving the material foundations of the welfare of all the nations concerned, and for ascertaining their location and extent.

We recognize as natural resources all materials available for the use of man as means of life and welfare, including those on the surface of the earth, like the soil and the waters; those below the surface, like the minerals; and those above the surface, like the forests. We agree that these resources should be developed, used and conserved for the future, in the interests of mankind, whose rights and duties to guard and control the natural sources of life and welfare are inherent, perpetual and indefeasible. We agree that those resources which are necessaries of life should be regarded as public utilities, that their ownership entails specific duties to the public, and that as far as possible effective measures should be adopted to guard against monopoly.

Public Health.—Believing that the conservation movement tends strongly to develop national efficiency in the highest possible degree in our respective countries, we recognize that to accom-

plish such an object with success, the maintenance and improvement of public health is a first essential.

In all steps for the utilization of natural resources considerations of public health should always be kept in view.

Facts which can not be questioned demonstrate that immediate action is necessary to prevent further pollution, mainly by sewage, of the lakes, rivers and streams throughout North America. Such pollution, aside from the enormous loss in fertilizing elements entailed thereby, is an immediate and continuous danger to public health, to the health of animals, and, when caused by certain chemical agents, to agriculture. Therefore we recommend that preventive legislation be enacted.

Forests.—We recognize the forests as indispensable to civilization and public welfare. They furnish material for construction and manufacture, and promote the habitability of the earth. We regard the wise use, effective protection, especially from fire, and prompt renewal of the forests on land best adapted to such use, as a public necessity and hence a public duty devolving upon all forest owners alike, whether public, corporate or individual.

We consider the creation of many and large forest reservations and their permanent maintenance under government control absolutely essential to the public welfare.

We favor the early completion of inventories of forest resources, in order to ascertain the available supply and the rate of consumption and reproduction.

We recommend the extension of technical education and practical field instruction in forest conservation, afforestation and reforestation, so as to provide efficient forest officers whose knowledge will be available for necessary public information on these subjects.

Believing that excessive taxation on standing timber privately owned is a potent cause of forest destruction by increasing the cost of maintaining growing forests, we agree in the wisdom and justice of separating the taxation of timber land from the taxation of the timber growing upon it, and adjusting both in such a manner as to encourage forest conservation and forest growing.

We agree that the ownership of forest lands, either at the headwaters of streams or upon areas better suited for forest growth than for other purposes, entails duties to the public, and that such lands should be protected with equal effectiveness, whether under public or private ownership.

Forests are necessary to protect the sources of streams, moderate floods and equalize the flow of waters, temper the climate and protect the soil; and we agree that all forests necessary for these purposes should be amply safeguarded. We affirm the absolute need of holding for forests, or reforesting, all lands supplying the headwaters of streams, and we therefore favor the control or acquisition of such lands for the public.

The private owners of lands unsuited to agriculture, once forested and now impoverished or denuded, should be encouraged by practical instruction, adjustment of taxation, and in other proper ways, to undertake the reforesting thereof.

Notwithstanding an increasing public interest in forestry, the calamitous and far-reaching destruction of forests by fire still continues and demands immediate and decisive action. We believe that systems of fire guardianship and patrol afford the best means of dealing adequately with fires which occur, whether from natural causes, such as lightning, or in other ways; but we affirm that in addition thereto effective laws are urgently needed to reduce the vast damage from preventable causes.

Apart from fire, the principal cause of forest destruction is unwise and improvident cutting, which, in many cases, has resulted in widespread injury to the climate and the streams. It is therefore of the first importance that all lumbering operations should be carried on under a system of rigid regulation.

Waters.—We recognize the waters as a primary resource, and we regard their use for domestic and municipal supply, irrigation, navigation and power as interrelated public uses and properly subject to public control. We therefore favor the complete and concurrent development of the streams and their sources for every useful purpose to which they may be put.

The highest and most necessary use of water is for domestic and municipal purposes. We therefore favor the recognition of this principle in legislation and, where necessary, the subordination of other uses of water thereto.

The superior economy of water transportation over land transportation, as well as its advantages in limiting the consumption of the non-renewable resources, coal and iron, and its effectiveness in the promotion of commerce, are generally acknowledged. We therefore favor the development of inland navigation under general plans adapted

to secure the uniform progress of the work and the fullest use of the streams for all purposes. We further express our belief that all waterways so developed should be retained under exclusive public ownership and control.

We regard the monopoly of waters, and especially the monopoly of water power, as peculiarly threatening. No rights to the use of water powers in streams should hereafter be granted in perpetuity. Each grant should be conditioned upon prompt development, continued beneficial use, and the payment of proper compensation to the public for the rights enjoyed; and should be for a definite period only. Such period should be no longer than is required for reasonable safety of investment. The public authority should retain the right to readjust at stated periods the compensation to the public and to regulate the rates charged, to the end that undue profit or extortion may be prevented.

Where the construction of works to utilize water has been authorized by public authority and such utilization is necessary for the public welfare, provision should be made for the expropriation of any privately owned land and water rights required for such construction.

The interest of the public in the increase of the productiveness of arid lands by irrigation and of wet lands by drainage is manifest. We therefore favor the participation of the public to secure the complete and economical development and use of all water available for irrigation and of all lands susceptible of profitable drainage, in order to ensure the widest possible benefit. Special projects should be considered and developed in connection with a general plan for the same watershed. In the matter of irrigation, public authority should control the headwaters and provide for the construction of storage reservoirs and for the equitable distribution and use of the stored water.

Lands.—We recognize land as a fundamental resource, yielding the materials needed for sustaining population, and forming the basis of social organization. Increase in the productivity of the soil is a growing need, and the possession of the land by the men who live upon it not only promotes such productivity, but is also the best guarantee of good citizenship. In the interest of the homemaker, we favor regulation of grazing on public land, the disposal of public lands to actual settlers in areas each sufficient to support a family, and the subdivision of excessive holdings of agricultural or grazing land, thereby preventing monopoly.

The preservation of the productivity of the soil is dependent upon rotation of crops, fertilization by natural or artificial means and improved methods in farm management. The quantity and quality of crops are also dependent upon the careful selection of seed. We therefore favor the distribution by government bureaus of scientific and practical information on these points, and we urge upon all farmers careful attention thereto.

The national importance for grazing of non-irrigable public lands too dry for cultivation and the public loss occasioned by overgrazing are generally acknowledged. We therefore favor government control of such lands in order to restore their value, promote settlement and increase the public resources.

The first requisite for forest or other covering which will conserve the rainfall and promote regularity of water flow is the retention of the soil upon watersheds. We therefore favor the construction of such artificial works as may effect this purpose and the encouragement thereof by remission of taxes, government cooperation, or other suitable means.

Minerals.—We recognize the mineral resources as forming the chief basis of industrial progress, and regard their use and conservation as essential to the public welfare. The mineral fuels play an indispensable part in our modern civilization. We favor action on the part of each government looking towards reduction of the enormous waste in the exploitation of such fuels, and we direct attention to the necessity for an inventory thereof. Such fuels should hereafter be disposed of by lease under such restrictions or regulations as will prevent waste and monopolistic or speculative holding, and supply the public at reasonable prices.

We believe that the surface rights and underground mineral rights in lands should be separately dealt with so as to permit the surface of the land to be utilized to the fullest extent, while preserving government control over the minerals.

Regulations should be adopted looking to the most economical production of coal and other mineral fuels and the prolongation of the supply to the utmost. We favor also the substitution of water power for steam or other power produced by the consumption of fuel.

Great economy in the use of fuel has resulted in the past from the application of scientific inventions and the use of improvements in machinery, and further progress can be made in the same direction. We therefore recommend that all possible encouragement and assistance be given in

the development and perfecting of means whereby waste in the consumption of fuel can be reduced.

The loss of human life through preventable mining accidents in North America is excessive. Much needless suffering and bereavement results therefrom. Accompanying this loss there is great destruction of valuable mineral property and enhancement of the cost of production. The best method of eliminating these known and admitted evils lies in the enactment and strict enforcement of regulations which will provide the greatest possible security for mine workers and mines. We therefore favor the scientific investigation of the whole subject of mine accidents by the governments participating in this conference, the interchange of information and experience and the enactment and enforcement of the best regulations that can be devised.

Mineral fertilizers should not be monopolized by private interests, but should be so controlled by public authority as to prevent waste and to promote their production in such quantity and at such price as to make them readily available for use.

Protection of Game.—We recognize that game preservation and the protection of bird life are intimately associated with the conservation of natural resources. We therefore favor game protection under regulation, the creation of extensive game preserves and special protection for such birds as are useful to agriculture.

Conservation Commissions.—The action of the President of the United States in calling this first conference to consider the conservation of the natural resources of North America was in the highest degree opportune, and the proceedings which have followed, and the information mutually communicated by the representatives assembled, have, we believe, been conducive to the best interests of the countries participating. To derive the greatest possible benefit from the work which has already been done, and to provide proper and effective machinery for future work, there should be established in each country a permanent conservation commission.

When such conservation commissions have been established, a system of intercommunication should be inaugurated, whereby, at stated intervals, all discoveries, inventions, processes, inventories of natural resources, information of a new and specially important character, and seeds, seedlings, new or improved varieties, and other productions which are of value in conserving or improving any natural resource shall be transmitted by each commission to all of the others, to the end that they may be adopted and utilized as widely as possible.

World Conservation Conference.—The conference of delegates, representatives of the United States, Mexico, Canada and Newfoundland, having exchanged views and considered the information supplied from the respective countries, is convinced of the importance of the movement for the conservation of natural resources on the continent of North America, and believes that it is of such a nature and of such general importance that it should become worldwide in its scope, and therefore suggests to the President of the United States of America that all nations should be invited to join together in conference on the subject of world resources and their inventory, conservation and wise utilization.

Gifford Pinchot,
Robert Bacon,
James R. Garfield,
Commissioners Representing the United States.

Rómulo Escobar,
Miguel A. de Quevedo,
Carlos Sellerier,
Commissioners Representing the Republic of Mexico.

Sydney Fisher,
Clifford Sifton,
Henri S. Béland,
Commissioners Representing the Dominion of Canada.

E. H. Outerbridge,
Commissioner Representing the Colony of Newfoundland.

Attest:

Robert E. Young,
Thomas R. Shipp,
Secretaries of the Conference.

Washington, D. C., February 23, 1909

SCIENTIFIC NOTES AND NEWS

The centenary of the birth of Darwin was commemorated at Syracuse University on March 19, by a meeting held under the auspices of the Syracuse Chapter of Sigma Xi, the Onondaga Academy of Science, the Syracuse Academy of Medicine, the Syracuse Botanical Club, the University Biological Association and the University Geological Club. Addresses were made as follows: "Darwin and Zoology," by Professor Charles W. Hargitt; "Darwin and Botany," by Professor William L. Bray; "Darwin and Geology," by Dr. John M. Clarke, state geologist, Albany.

Washburn College and the Kansas Academy of Science celebrated the centenary of

Darwin's birth on March 26, the program being: "Darwinism and Experimentation," Dr. D. T. MacDougal, director, department botanical research, Carnegie Institution of Washington; "Evolution of Organisms in Relation to Environment," Professor W. L. Tower, department of zoology, University of Chicago.

THE Wellesley College Science Club held its one hundredth meeting on March 9 in the Whitin Observatory, when the program was devoted to Charles Darwin. Dr. Robertson gave an account of the status of biology before Darwin's time and the changes wrought by him. Dr. Ferguson followed, giving an account of the influence of Darwin's work on botanical science. Dr. Wiegand then gave a paper on "Modern Theories of the Origin of Species and their Relation to Natural Selection." Professor Hayes was the last speaker.

DARWIN memorial exercises were held at the Michigan Agricultural College on March 4, with the following program: "Early Impressions of Darwinism," Dr. W. J. Beal; "Darwin, the Worker," Professor W. B. Barrows; "Darwin's Influence on Thought," Dr. R. M. Wenley.

THE daily papers state that it is proposed to offer the ambassadorship to Great Britain to President Eliot after his retirement from the presidency of Harvard University. Mr. Eliot, who is at present making addresses in the south, reached his seventy-fifth birthday on March 20.

A BANQUET in honor of President Angell was given in New York City on March 19 by alumni of the University of Michigan.

THE seventh annual meeting of the South African Association for the Advancement of Science will be held at Bloemfontein at the end of September under the presidency of Sir Hamilton J. Goold-Adams.

DR. SVEN HEDIN has lectured in the presence of Emperor William before the Berlin Geographical Society, which awarded to him its Humboldt medal. He has also lectured at the Sorbonne, Paris.

PROFESSOR W. M. DAVIS, of Harvard University, has finished his courses at Berlin and has gone to Scotland to deliver a series of lectures on geology before Edinburgh University.

SIR E. RAY LANKESTER will deliver the Huxley lecture for the present session at Birmingham University.

PROFESSOR WM. T. SEDGWICK, of the Massachusetts Institute of Technology, expects to leave Boston in the middle of April to make a number of addresses in the middle west.

AT the meeting of the Society of Arts of the Massachusetts Institute of Technology on March 25, President R. S. Woodward, of the Carnegie Institution, was expected to lecture on the work of the institution. On April 5 Professor George E. Hale, director of the Solar Observatory of the Carnegie Institution, is announced to lecture on "Solar Cyclones and Magnetic Fields."

DR. A. M. STEIN will give a lecture under the auspices of the Royal Asiatic Society on Tuesday, March 30, on his recent explorations in eastern Turkestan.

MR. D. CARRUTHERS, who took part in the British Museum expedition to Ruwenzori as a zoological collector under Mr. R. B. Woosnam in 1906, is at present exploring central Arabia.

DR. CHEVALIER, who since the conclusion of his expedition to the upper Shari basin, has been on the Guinea coast, has started on a new expedition to west Africa.

THE National Society of Acclimatization of France has conferred on Mr. W. Percival Westell its bronze medal in recognition of his natural history writings.

WILLIAM STUART, for the past ten years professor of horticulture in the Agricultural Department of the University of Vermont, has received an appointment in the plant bureau of the Department of Agriculture, Washington, and will enter upon his new duties at the close of the college year.

MRS. TYNDALL, in pursuance of the wishes of the late Professor Tyndall, who was a member of the Royal Commission appointed in 1879 to inquire into the causes of explosions in coal mines and who took a deep interest in problems concerning the safety of miners, proposes to found a gold medal to be awarded

annually for inventions tending to diminish danger and preserve life among those engaged in mining operations. The adjudication of this "Tyndall Medal" is to be placed in the hands of the managers of the Royal Institution, where Professor Tyndall occupied the chair of Natural Philosophy from 1853 to 1887.

It is proposed to endow as a memorial to the late Dr. William T. Bull an institution for surgical research to be connected with the College of Physicians and Surgeons, Columbia University, from which Dr. Bull was graduated in 1872, and where he served for many years as professor of surgery. It is further stated that Mrs. Bull proposes to erect a memorial hospital for the treatment of tuberculosis.

Professor Mark Vernon Slingerland, who held the chair of economic entomology at Cornell University, and was an authority on the injurious insects of the United States, died at Ithaca on March 10, at the age of forty-four years.

Major Edmund Lewis Zalinski, U.S.N., retired, at one time professor of military science in the Massachusetts Institute of Technology, known for experimental work on high explosives, died in New York City on March 10, at the age of fifty-nine years.

Dr. S. H. Laurie, emeritus professor of education in the University of Edinburgh, died in Edinburgh on March 2 at the age of seventy-nine years.

Dr. Emil Erlenmeyer, formerly professor of chemistry in the Munich Technical Institute, has died at the age of eighty-three years.

The deaths are also announced of M. Frédéric Rauh, professor of philosophy at Sorbonne, and Senhor Barbosa Rodrigues, author of several works on the Brazilian flora.

A recent list of the publications of the United States Geological Survey gives the titles of 977 volumes. This list does not include the separate chapters from the annual volume on mineral resources, which make up several hundred pamphlets.

It is now finally settled that the Forest Service Experimental Laboratory will be situated at the University of Wisconsin. Opportunity was given to Michigan and Minnesota to present the advantages of those institutions, but the original plan will be carried out. Work on the new laboratory, which is to be located on Camp Randall near the agricultural buildings and the new site of the engineering group, will be begun at an early date. The university provides the site and a $30,000 building, while the forest service is to equip the laboratory at a cost of $14,000 and to provide the entire staff of investigators, whose salaries will aggregate $28,000 a year. The laboratory is to be available for students and faculty of the university for research work, and the members of the staff are to deliver lectures on forestry and allied subjects to students of the university. A course for forest rangers is to be provided by the university in connection with the experiment station as soon as it is completed. The work of the laboratory is to include tests of various kinds of wood for paper pulp, for building material, for the distillation of turpentine, alcohol and resin from wood waste.

APPROPRIATIONS FOR THE UNITED STATES BUREAU OF EDUCATION

The estimates of appropriations for the United States Bureau of Education for the fiscal year ending June 30, 1910, as transmitted to Congress, included under the general head of salaries estimates for additional employees as follows: Expert in higher education, $4,000; expert in industrial education, $3,000; expert in the welfare of children, $3,000; editor, $2,000; additional clerks, $12,100. Of the new employees requested, Congress made provision for an editor at $2,000; one clerk at $1,200; and one clerk at $1,000. The salary of the Commissioner of Education was increased from $4,500 to $5,000, making a total increase in the appropriations for the general work of the Bureau of $4,700 over the appropriations for the current fiscal year. The requests for a lump sum appropriation of $40,000 for educational investigations; for an increase of $1,500 in the appropriation for the library; for an increase of $8,000 in the fund for collecting statistics; and of an ap-

propriation of $39,000 for rent, metal shelving, additional furniture, and removal of the Bureau to new quarters, did not receive the favorable consideration of Congress.

The appropriation for the education of the natives of Alaska remains the same as for the present year, $200,000. The appropriation for reindeer in Alaska was reduced, on the recommendation of the Commissioner of Education, from $15,000 to $12,000. Provision was made by Congress for the designation of employees of the Alaska School service as special peace officers to assist in the enforcement of law in Alaska.

UNIVERSITY AND EDUCATIONAL NEWS

GIFTS amounting to $176,960 from Mr. John D. Rockefeller to the University of Chicago were announced on March 16 by President Judson at the recent convocation. The larger part is for the College of Education.

THE New York *Evening Post* states that the University of Missouri will receive $500,000, for the assistance of needy students, by the will of Charles R. Gregory, of St. Louis, who recently died in Paris.

THE Weyerhauser interests of St. Paul have given to the University of Minnesota 2,200 acres of land in Carlton County for the use of experiments by the forestry department.

IN accordance with the terms of the will of the late Dr. Julian Hunter that the name of his father—Joseph Hunter—should be perpetuated in connection with his bequest to Sheffield University, the council has resolved to call the chair of pathology in the university the "Joseph Hunter Chair of Pathology." It is proposed with the Hunter bequest (amounting to £15,000) to establish a chair of economics and to carry on the department of philosophy and logic under a lecturer.

THE Goldsmiths' Company will renew for a further period of three years their annual grant of £5,000 towards the maintenance of Goldsmiths' College, New-cross.

MR. R. O. KING, a former graduate of the faculty of applied science and a demonstrator in physics at McGill University, has established a fellowship in physics of the value of $600.

EFFORTS are being made to collect $500,000 to establish a medical school at Pekin.

IT is reported in the daily papers that thirteen college presidents, whose institutions are among those classed as denominational, have presented a memorial to Dr. Henry S. Pritchett, president of the Carnegie Foundation. The memorial urges that many colleges which were founded by religious bodies are to-day free to men of all creeds and do not teach particular dogmas or require any particular beliefs by students or professors. They are, therefore, it is declared, practically non-sectarian.

MR. GEORGE R. PARKIN has sent a letter to members of the American Committees of selection for the Rhodes Scholarships at Oxford, stating that the trustees of the trust have decided that any candidate from the United States who has passed the qualifying examination in Latin and mathematics shall be eligible, even though he may not have passed in Greek. He will, however, be required to pass the examination in Greek before going into residence or at all events before receiving a degree.

THE American Ethical Union will hold its summer school at the University of Wisconsin from June 28 to July 24, under the direction of Dr. Felix Adler, of Columbia University.

THE inauguration of Professor A. Lawrence Lowell as president of Harvard University, will occur some time in October; the exact date has not been set.

THE president's European fellowship of Bryn Mawr College has been awarded to Miss Grace Potter Reynolds, B.A. (Smith), M.A. (Columbia) and formerly assistant in chemistry at Barnard College, Columbia University.

AT the School of Pharmacy of Western Reserve University, Professor W. H. Haake has resigned as professor of materia medica and is succeeded by Dr. Torald Sollmann.

DR. DAVID FRASER HARRIS has been appointed lecturer in physiology at Birmingham University to succeed Dr. Rhodes.

DISCUSSION AND CORRESPONDENCE

NOTE ON THE SPECTRUM OF MARS

I THINK that Professor Very's article on "The Presence of Water Vapor in the Atmosphere of Mars,"[1] though written with the kindliest feelings for all concerned, is certain to convey a wrong impression as to the observations made by Huggins, Vogel and others in the sixties and seventies and by myself in 1894–5. The pioneer observers believed they saw in the spectrum of Mars the modifying influences of oxygen and water vapor in its atmosphere. I held, and published, the opinion that "the polar caps on Mars are conclusive evidence of an atmosphere and aqueous vapor" on that planet;[2] but my spectroscopic observations, made under vastly improved conditions, convinced me that oxygen and water vapor did not exist in sufficient quantities to be detected by the spectroscopic method as then available, for this method is a very insensitive one. The observations by the earlier observers, and by myself, were confined to the spectral region λ5400 to λ6900. The region of wave-lengths *larger than λ6900* was entirely too faint for visual study, and in those days we had not the means of photographing it. About two years ago it was discovered that the application of certain chemicals to an ordinary dry-plate would make it quite sensitive to radiations of greater wave-lengths than λ6900. In the region thus rendered available, at λ7175, is the so-called little "*a*" band, due to water vapor. It is this band, in a region previously unobserved and unobservable in Mars' spectrum, upon which Professor Very's work is based exclusively. His investigations, therefore, afford no evidence as to the correctness of the early observations.

Now comes the point, omitted by Professor Very, which does bear upon the early observations. The spectrum photographs used by Very (made by Mr. Slipher at Flagstaff) recorded not only the new region containing the band "*a*," but also the old region λ5400 to λ6900. Mr. Slipher's published conclusion, as based on his series of seven spectrum photographs, is that "Aside from reinforcement of the '*a*' band (at λ7175), the spectrum of Mars shows no selective absorption not found in that of the moon photographed under the same conditions";[3] that is, *the effects of oxygen and water vapor on Mars were no more visible in the region λ5400–λ6900 of the spectrum than were the effects of oxygen and water vapor existing on the moon!*

Only those who have seen Mr. Slipher's original negatives can judge of their value; but whatever their value, they are absolutely confirmatory of my visual observations of 1894, of my photographic observations of 1895, of Professor Keeler's photographic observations of 1897; and as absolutely opposed to the observations of Huggins, Vogel, Maunder and others as my own observations were. Readers of Very's article would get exactly the opposite view.

If Mr. Slipher, observing from a high altitude and with little water vapor in our atmosphere to embarrass him, could see no difference between the spectra of Mars and the moon in the region λ5400–λ6900, how impotent were the effects of the pioneer observers at sea-level, with small telescopes, looking through ten times as much water vapor as Mr. Slipher and I did; yet, all hail, and nearly all the credit to the pioneers! Their work, though unsuccessful, makes progress possible by succeeding generations of investigators.

W. W. CAMPBELL

MT. HAMILTON,
February 6, 1909

[1] SCIENCE, January 29, 1909, p. 191.

[2] *Astronomy and Astrophysics*, 1894, p. 760.

[3] *Astrophysical Journal*, 28, p. 403, 1908.

A NEW KIND OF PTARMIGAN

TO THE EDITOR OF SCIENCE: The current *McClure's Magazine* (March, 1909) contains a sonnet which I am sure will entertain the readers of SCIENCE, even though it bears the gruesome title "The Shipwrecked Sailor." It contains this striking (in more senses than one) bit of ornithological news:

Yet he smiled,
Abandoning hope and drowning unaware,

Till a great sea-bird, tern or ptarmigan,
Caught by the whiteness of his lonely face,
Swooped low exultantly; huge swish of wings
Measuring his body, as he struck him once.
Thud of the ribbed beak, like a call to arms
Stirring the wounded soldier, etc."

What would not Mr. Chapman give for a moving picture of the author's mental image of a ptarmigan? Would it be in order, since Miss Florence Wilkinson is the writer to whom we are indebted for a description of this new species, to call the Ribbed-beaked Ptarmigan, *Lagopus wilkinsoni?*

HUBERT LYMAN CLARK

SCIENCE AND POLITICS IN CUBA

TO THE EDITOR OF SCIENCE: I have just learned that the new Cuban administration has asked for the resignation of all the Americans on the staff of the Cuban Agricultural Experiment Station. This is purely a political move made to supply more places for the horde of hungry office seekers. No comment is needed when a government is willing to make a political football of its only efficient scientific institution. The following is a list of those who have been so suddenly and unjustly deprived of their positions. I know all of these gentlemen personally and am familiar with their work. Many of them are former colleagues. I take a great pleasure in heartily recommending them to any institutions who may have vacancies in these respective lines.

Dr. N. S. Mayo, Chief, Department of Animal Industry.
Mr. J. S. Montgomery, Assistant, Department of Animal Industry.
Professor Wm. T. Horne, Chief, Department of Vegetable Pathology and Entomology.
Mr. J. S. Houser, Assistant, Department of Vegetable Pathology and Entomology.
Professor R. S. Stark, Chief, Department of Chemistry.
Dr. H. Hasselbring, Chief, Department of Botany.
Professor C. F. Austin, Chief, Department of Horticulture.
Mr. C. F. Kinman, Assistant, Department of Horticulture.

F. S. EARLE

SCIENTIFIC BOOKS

Laboratory Notes on Industrial Water Analysis. A Survey Course for Engineers. By ELLEN H. RICHARDS, Instructor in Sanitary Chemistry, Massachusetts Institute of Technology. 8vo, pp. iii + 49. Cloth, 50 cents net (2s. net). New York, John Wiley & Sons; London, Chapman & Hall, Limited. 1908.

The book is written for the use of students of engineering and deals with "boiler waters" principally.

Part I. is divided into five laboratory exercises: First, Classification of a Water as "Scale-forming," "Moderately Scale-forming," or "Corrosive"; second, Determination of "Total Solids," "Incrustants," "Iron" and "Sulphates"; third, "Alkalinity," "Magnesium as Hydrate" and "Permanent Hardness"; fourth, "Action Upon Metals," "Oxygen Consumed" and "Dissolved Oxygen"; fifth, "Remedies for Defects Found in Waters." "Only special methods are considered, leaving out the ordinary analytical processes to be found in text-books."

Part II. is devoted to the preparation of "standard solutions" and to sundry tables useful in water analysis.

The following sentence is well worthy of attention, as it points to a fact often lost sight of: "Water unsatisfactory for one purpose may be, or may be made, quite satisfactory for another."

Mrs. Richards has had such extended experience in matters dealing with water examination that anything from her pen is always of value.

W. P. MASON

A Laboratory Guide for Histology. By IRVING HARDESTY, A.B., Ph.D., with a chapter on Laboratory Drawing, by ADELEBERT WATTS LEE, M.D. With 30 illustrations, 2 of which are in colors. Pp. 193. Philadelphia, P. Blakiston's Son & Co. 1908.

That there is a place for such a well-planned, practical series of laboratory outlines for the study of histology and microscopic anatomy as are found in this guide the reviewer has no

doubt. The volume is a timely contribution and is characterized by all the excellencies which one is led to expect from a knowledge of the other publications of this careful and experienced teacher. Pedagogically considered, aside from its lopping off of superfluities, its greatest virtue lies in the manner in which the student is impelled to get at the subject interpretatively instead of blindly following descriptions. The method is not wholly inductive, however, since the student is expected to know what is said in his text-book or lectures on a given subject; nevertheless, through a judicious use of questions he is forced to think for himself and not simply to verify statements.

One great aim of the author has been to do away with the numerous irrelevant procedures at which the student is likely to fritter away his time and to lead him at once to see and to accomplish the real work that is to be done. The main idea has been to have him so utilize his time as to cover thoroughly the greatest possible amount of ground in the time allotted to the course. The outlines are the outgrowth of the author's own experience as a teacher and having been revised and corrected year after year, in their final form they represent, therefore, just what in his experience may most advantageously be undertaken by the average class in histology working three three-hour periods per week throughout one school year.

In case a school can not give three afternoons a week to the course, however, the work is so arranged that it can be given conveniently in two separate years. The reviewer is of the opinion, indeed, that the third section might well be reserved for the second year as it in itself constitutes a complete course in the gross and microscopic anatomy of the central nervous system and the organs of special sense, and includes work of considerably greater difficulty than that of the other two sections.

The author rightfully insists throughout the work upon the importance of having the transition from the macroscopic to the microscopic detail made with sufficient fulness for the student to get a complete mental picture of the structure as a whole instead of the mere fragments he too often gets when stained and sectioned material chiefly is used.

The arrangement of topics and the classification of structures is made mainly upon an anatomical and functional rather than an embryological basis. The practical utility of such an arrangement would seem sufficient to justify it even though an embryological arrangement would leave the student with a clearer morphological perspective of the general field. For the medical student, at least, the imperative demand is for the functional rather than the morphological conception. The embryological side, however, has not been slighted, for the principles and processes of development are kept well in the foreground and there are frequent demands for the study of sections of embryos and preparations of developing tissues and organs.

A valuable chapter is that by Dr. A. W. Lee on Laboratory Drawing in which a very enlightening discussion of drawing materials and methods is given. As Dr. Lee himself expresses it, "The individual who 'can't draw' has constantly been kept in mind; in fact, this chapter was undertaken solely for his benefit." Such a clear and non-technical discussion of laboratory drawing has long been a desideratum and it should not be reserved for those who study histology merely but should be brought to the attention of all biological students. Original drawings in varying stages of completion are employed as an aid in illustrating more graphically the principles involved. Unfortunately, by what is clearly a typographer's error, the block for figure 13 has been rotated ninety degrees with the result that the parallel which the author intended to show between this and the preceding figure is somewhat obscured.

A few of the seemingly inevitable typographical errors have crept into the volume here and there, but none is of great magnitude. Some of the most noticeable are as follows: page 40, formation for information; page 45, aquamous for squamous; page 54, glyerin for glycerin; page 72, cosmic for osmic, and the same on page 73; page 73, non-modullated for non-medullated; page 139,

Ralando for Rolando, and page 180 in the last line *of* has been omitted.

An important adjunct to the work is the well-chosen list of original papers which is given at the end of the outline for each general subject. While not intended to be exhaustive it is thoroughly representative and includes all that the student could possibly utilize to advantage at this stage of his development.

The volume as a whole is a meritorious contribution from a skillful teacher and is a welcome addition to the histological laboratory. MICHAEL F. GUYER

The Fauna of Mayfield's Cave. By ARTHUR M. BANTA. Pp. 114, with plates, map of the cave, figures and tables. Published by the Carnegie Institution, Washington, D. C., September, 1907.

Mayfield's Cave is in Monroe County, Indiana, 4.5 miles northwest of Bloomington, the location of the Indiana University. It has often been visited, and its contents have been described in part by Bollman, Hay, Blatchley, Call, Eigenmann and others. What has been admirably done by Arthur M. Banta is to visit it on an average once a week during eight months in all, covering different seasons of the years, 1903, 1904 and 1905, using the strong, steady light of a carbide bicycle lamp, observing all phenomena, noting the temperature and air currents, and in particular collecting all varieties of animal life for detailed study with the facilities afforded by the laboratory of the university and the expert aid of C. H. Eigenmann. Contours for the cave map are by J. W. Beede, and the photographs are by E. R. Cummings. Full recognition of work done by others is made in the introduction, and in a bibliography mentioning more than 130 works and papers consulted.

Mayfield's Cave is only a fourth of a mile long, is from 6 to 20 feet wide, and is nowhere more than 12 feet high, while many passages are mere crawl-ways. The roof is usually flat and hard limestone, with small domes here and there. The floor is strewn with large and small fragments of stone, with patches of gravel or soil, and occasional banks and mounds of earth. The excavation is in the Mitchell limestone of the upper Subcarboniferous. The entrance is in a low bluff at the head of a ravine once a part of the cave. There are sink-holes without and springs within, and in winter and spring a cave stream flows through, which ceases to flow in summer, leaving detached pools, parts of the channel remaining moist and other parts being quite dry. The temperature of the earth tends to counteract that of the air currents from without, bringing the average to about 11.9° C., equalling the mean temperature of the region.

Cavern fauna depend on an irregular food-supply and lead a precarious life. Flowing water brings in algæ, worms, insects, seeds and other material; mammals and human visitors leave various reminders; and fungus grows abundantly on decaying organic matter. Dry parts were poor collecting ground, while better results were had in moist localities. Most cave animals are scavengers. Some are strays, or accidental visitors; others visit voluntarily; while true cavernicola are classified as temporary, permanent and exclusive residents—the latter never found elsewhere. Banta also classifies them in their relation to daylight, twilight and darkness.

Sixty-six pages are devoted to detailed scientific descriptions of the fauna of Mayfield's Cave, under the heads of Mammalia, Pisces, Insecta, Myriopoda, Arachnida, Crustacea, Annelida, Mollusca and Turbellaria. Six pages are filled by comparative tables of species known to exist in Indiana caves as compared with those found in this single cave; the sum total being 138 species, 110 of which exist in Mayfield's Cave. This is certainly remarkable.

Of true cave fauna the most space is allotted to the blind fish (*Amblyopsis spelæus,* DeKay) concerning which curious experiments were made as to its habits, anatomy and its food as determined by inspecting the contents of the stomach. Two varieties of cave crawfish were found (*Cambarus pellucidus,* Packard, and *Cambarus pellucidus testii,* Hay); the distinction being the presence or the absence of spines. To the cave-

hunter these and other descriptions of strange and unusual forms of life are fascinating.

Several pages are occupied by general observations, with an interesting discussion of the origin of cave life. The latter is treated under three questions: (1) How did these animals get into the caves? (2) What was their condition when they entered? (3) How have they reached their present state? Answering these inquiries the author argues that cave animals originated from outside forms, being predetermined to such cave conditions as suited them; that, at first, they differed slightly from similar forms, but were better adapted than they for subterraneous existence; and that they reached their present condition by gradual adjustment to environment, modified by cumulative variations due to heredity.

Taking the monograph as a whole, Mr. Banta is to be congratulated on having given a most commendable example of what can be done by an exhaustive study of a small cavern, and on having thus made a valuable contribution to scientific literature.

Horace C. Hovey

SCIENTIFIC JOURNALS AND ARTICLES

Terrestrial Magnetism and Atmospheric Electricity for March contains the following articles: "L'Observatoire Magnétique de Zi-ka-wei," by J. de Moidrey; "Carnegie Institution Comparisons of Magnetic Standards during 1908," by J. A. Fleming and J. C. Pearson; "The Carnegie Institution Marine Collimating Compass," by W. J. Peters; "Some Problems in Radioactivity," by A. S. Eve; "Peculiar Magnetic Disturbances in December, 1908," by D. L. Hazard.

The American Naturalist for March contains the papers read at the Darwin Memorial Session of the Baltimore meeting of the Botanical Society of America, held December 29. These papers are: "Darwin as a Naturalist: Darwin's Work on Cross Pollination in Plants," by William Trelease; "Darwin's Influence upon Plant Geography and Ecology," by Frederic C. Clements, and "Darwin's Work on Movement in Plants," by Herbert Maule Richards. In addition there is "An Examination of Darwin's 'Origin of Species' in the Light of Recent Observations and Experiments," by Edwin Linton. Edward M. East discusses "The Distinction Between Development and Heredity in Inbreeding," and T. H. Morgan describes some results of "Breeding Experiments with Rats," the species being *Mus rattus, M. alexandrinus* and *M. decumanus*. Among the "Shorter Articles" is a note by Roy L. Moodie, stating that in parts of the Niobrara River the chub, *Semotilus,* has acquired the habit of feeding on the horn fly that infests cattle, follows up the cattle and captures flies by jumping and picking them from the animal's sides.

Bird-Lore for January-February contains articles on "The Hollow Tree," by Ernest T. Seton; "The Feud of the Crows and the Owl," by Frank M. Chapman; "Birds seen in Prospect Park, Brooklyn," by Kate P. and E. W. Victor; "Notes on Pacific Coast Shore Birds," by John T. Nichols, and the eighth and last paper on "The Migration of Flycatchers," by W. W. Cooke. The Ninth Christmas Bird Census gives the results of observations from a large number of localities and the "Report of Audubon Societies" records the painful fact that two Audubon wardens have been brutally murdered. This illustrates the character of some of the men engaged in "the feather business." It used to be said that each elephant tusk cost the lives of three men and we await statistics on aigrettes.

In the *American Museum Journal* for February Roy C. Andrews describes "A Summer with the Pacific Coast Whales," illustrated with some remarkable views from life. E. O. Hovey tells of "St. Pierre and Mt. Pelé in 1908," giving some illustrations showing how rapidly vegetation is springing up over the region devastated by the eruption of 1902. New exhibits have been arranged illustrating the industries of the California Indians, and it is noted that the museum has acquired the Waters collection of Fiji objects.

On February 28 a Brazilian tapir was born at the National Zoological Park, Washington, D. C., making the fifth of this species that

has been born there. The period of gestation was 401 days; in another instance it was 395 days. The little tapirs have been strong and were raised with comparatively little trouble.

NOTES ON ENTOMOLOGY

THREE more volumes have been issued by the Indian government in the series "The Fauna of British India." Two are on the Coleoptera. Volume I. is on the Cerambycidæ, by C. J. Gaham (329 pp., 107 figs.), and deals with nearly one half of the longicorn beetles of India. They are arranged in four subfamilies—Cerambycinæ, Lepturinæ, Disteniinæ and Prioninæ. Nearly 400 species are described. Vol. II. (Coleoptera), on the Chrysomelidæ, is by the late Martin Jacoby (534 pp., 172 figs., 2 colored plates). He arranges the forms in five divisions: Eupodes, Cyclica, Camplosomes, Trichostomes and Cryptostomes. The species of the last two divisions are not treated in this volume; the Trichostomes include the Halticinæ and the Galerucinæ. Over 900 species are described, many of which are new. Volume IV. of the Rhynchota (Homoptera and appendix, 501 pp., 282 figs.) is by Dr. Distant. It contains the families Membracidæ, Cercopidæ and Jassidæ; the appendix is mostly on the Pentatomidæ. In this volume 665 species are described, bringing the total number of Hemiptera described from India up to 2,768.

MR. EDWARD CONNOLD has published on the British oak galls a companion volume to his work on British vegetable galls.[1] There are chapters on the growth of galls, characters and habits of the Cynipidæ, the British oak, and collecting and mounting oak galls. There is, under each species, a succinct statement comprising the English name of the gall, the position of the gall, the manner of growth, color, size, time of year, whether with one or many larvæ, where larva pupates, time of issuance of fly and parasites and inquilines. The insects are not described. Fifty-four galls of Cynipidæ are treated, and two of other insects. The plates are photographs of the various galls, often showing much variation in shape.

MR. R. E. TURNER has completed a revision of the Australian species of a peculiar family of Hymenoptera, the Thynnidæ.[2] This family is extremely abundant in Australia, about 400 species being known, over 120 of which are described as new by Mr. Turner. Very little is as yet known of their life history; a few bred from underground pupæ of Lepidoptera or Hymenoptera. The author severely criticizes the classification of Ashmead, but adopts most of the genera of Guèrin and Westwood. The characters at present used for the genera are found mostly in the sexual organs; a better classification must await the discovery of characters associating the sexes. Mr. Turner excludes from this family the genus *Anthobosca,* which he considers more related to *Myzine.* With the exception of the genus *Ælurus* the South American Thynnidæ are of different genera than the Australian.

PROFESSOR WHEELER has written a most interesting comparative study of the ants of Europe and North America.[3] He shows that there are fully twice as many kinds of ants in the United States as in Europe. In both countries the ant-fauna is composed of two elements, the boreal and the tropical. The former is very similar in the two regions, but the latter is very divergent, owing to different origins. The difference in nidification of similar ants in Europe and North America is considered due to the amount of sunshine; and it is shown that nests are more abundant in the interior of our country than in the eastern states. There is a summary of the fossil ants of the two countries; a chapter on the parasitic ants of Europe and on the myrmecophilous insects.

MR. W. SCHULTZE has an interesting article on the young of certain leaf-beetles of the

[1] "British Oak Galls," London (Adlard & Son), pp. 170, 68 plates, 1908.

[2] "A Revision of the Thynnidæ of Australia," *Proc. Linn. Soc. N. S. Wales,* XXXII., pp. 206–290, 1907; XXXIII., pp. 70–256, 1908.

[3] "Comparative Ethology of the European and North American Ants," *Journal f. Psychologie u. Neurologie,* XIII., pp. 404–435, 1908, 2 double plates.

family Cassididæ.[4] Many larvæ of these beetles have peculiar lateral expansions of the body, and a long spiny or bristly tail, which accumulates excrement and cast-skins, and is recurved over the body. When disturbed the larvæ erect and wave these tails. He concludes that these structures are used principally as a protection against parasitic enemies. The eggs are enclosed in a case, frequently one in each case, and these cases are often covered with excrement.

Mr. H. S. Smith has published a most useful work on the Hymenoptera of Nebraska,[5] a synoptic and descriptive catalogue of the Sphegoidea of that state. There are tables to the genera and species, and descriptions of fifteen new forms; altogether over 200 species are recorded from the state. It is hoped that some eastern hymenopterists will follow the example.

Professor E. B. Poulton has published a detailed museum study of our butterflies of the genus *Limenitis*,[6] tending to show the influence of *Anosia plexippus* and *Danaida berenice* upon *L. archippus*, and its varieties. He also considers that *L. californica* is the model of *L. lorquini*. Although he brings out many interesting points about coloration and pattern, one can not fail to notice the paucity of field observations which alone are of determining importance in these matters. The author considers that *Papilio philenor* is mimicked by three other species of the genus —*P. troilus, P. asterius* (female) and *P. glaucus* (female), which would hardly be suspected by any one familiar with these butterflies in the field.

Mr. W. Lundbeck has published the second part of his book on Danish diptera.[7] As with the preceding part, this is a most excellent treatment of the subject. The structural characters are given in great detail; there is a good account of habits and life-history; and under the Asilidæ are numerous records of their prey, showing that there is no mimicry of their prey by these ferocious flies. Although the species known from Denmark are very few, the author's treatment of the genera and families is so full as to make the work a most useful one to the American dipterist.

Attention should also be called to the recent catalogue of Argentine Diptera by Dr. J. Brèthes.[8] He lists the flies of Argentina, Patagonia, Uruguay and Paraguay, 650 species in all; mostly in the Asilidæ and Syrphidæ. There are 23 species of mosquitoes.

Nathan Banks

[4] "Life Histories of some Philippine Cassididæ," *Phil. Journ. Sci.*, III., pp. 261–271, 6 pls. 1908.

[5] "The Sphegoidea of Nebraska," *Univ. Studies*, Vol. VIII., No. 4, October, 1908, pp. 88, 1 plate.

[6] "Mimetic North American Species of the Genus *Limenitis* and their Models," *Trans. Ent. Soc. Lond.*, 1908, pp. 447–488, 1 plate.

[7] "Diptera Danica; Genera and Species of Flies Hitherto Found in Denmark." Part II., Asilidæ, Bombylidæ, Therevidæ, Scenopinidæ. Copenhagen, 1908, pp. 162, 48 figs.

[8] "Catalogo de los Dipteros de las Republicas del Plata," *Anales Mus. Nac. Buenos Aires* (3), IX., pp. 277–305, 1908.

SPECIAL ARTICLES

CONCERNING THE EXISTENCE OF NON-NITRIFYING SOILS

It is believed by agricultural specialists as well as by bacteriologists that soils generally have the power to convert organic or ammoniacal nitrogen into nitrate nitrogen, *i. e.*, to nitrify. Nitrifying organisms are supposed to abound to such an extent that any stratum not possessing them would soon become inoculated with them by air, soil, manure, water or other means.[1]

Filter beds, originally non-nitrifying, soon become vigorous nitrifiers without inoculation; sewage nitrifies freely in running streams; nitrate as saltpeter is of almost universal natural occurrence. A surface soil which can not nitrify would be regarded as a rare anomaly, therefore, and that many such non-nitrifying soils exist, could not be expected from the generally assumed conditions.

During our work of the past few years, we have, however, been repeatedly confronted with the fact that many of our soils do not nitrify. The first evidence of the existence of non-

[1] Le Far, "Handbuch der Technischen Mykologie," III., 147.

nitrifying soils was afforded in 1903 during an attempt of one of us to demonstrate nitrification to a class in bacteriology after the usual laboratory manner.[2] The attempt resulted in a complete failure to secure nitrification. This observation was confirmed by the other at a later time while working independently with other soils. This is noted on page 14 of the report of the North Carolina Agricultural Experiment Station, 1906–7. Since that time, in connection with our studies in nitrification, many samples of soils have been tested for nitrifying power with the result that a large majority of the soils of this region are found to be devoid of this power. The numbers of the soils tested, dates, mode of test, whether in soil or in solution, and the results, are given in the following table.

The tests in solutions were made by the usual method of placing from 0.2 g. (Ashby's Method) to 5 or 10 g. of the soil to be tested into an ammoniacal solution such as that of Omelianski, Wiley or Ashby.

Tests in soil were made by adding nitrogenous material, organic or ammoniacal, to the live soil or by sterilizing the soil, adding the nitrogen, then inoculating with a suspension of the soil to be tested, incubating, shaking with water, filtering, clarifying and analyzing.

Soils which are reported here as negative did not give enough nitrate or nitrite to respond to the diphenylamine test.

SAMPLES OF LOCAL SOILS

29 per cent. nitrifiers.

71 per cent. non-nitrifiers.

LOCAL SOILS

37 per cent. nitrifiers.

63 per cent. non-nitrifiers.

It is seen that of the 62 local samples tested in soil culture, 44, or 71 per cent., failed to nitrify, 18, or only 29 per cent., nitrified; of the 40 different local soils tested 15, or 37 per cent., nitrified while 25, or 63 per cent., failed to nitrify, even though soils which sometimes nitrified slightly and sometimes failed, as Nos. 1783 and 1746, are recorded for this purpose as nitrifying soils.

[2] Buxton, B. H., *Jour. Ap. Mic.*, 5, p. 1975.

Soil	Date of Sampling	Results in:	
		Soil	Solution
1830	October 3, 1905	0	
1855	November 21, 1905	0	
1830	December 5, 1905	0	
1830	February 7, 1906	0	
Plat 12	February 26, 1906	0	
1540	September 17, 1906	0	
1540	October, 1906	0	+
1540	August 10, 1908	0	
1549	September 17, 1906	0	
1549	August 10, 1908	0	0
1667	October 31, 1907	0	0
1667	April 23, 1908	0	0
1667	August 6, 1908	0	0
1746	September 17, 1906	0	
1746	October, 1906	+	+
1746	August 10, 1908	0	0
1783	September 17, 1906	0	
1783	October, 1906	+	+
1783	August 13, 1908	0	0
1784	September 17, 1906	+	
1784	August 13, 1908	0	0
1859	November, 1906	0	
1860	November, 1906	0	
1861	November, 1906	+	
1862	November, 1906	0	
1863	November, 1906	0	
1864	November, 1906	0	
1865	November, 1906	0	
1866	January 23, 1907	+	0
1866	October 21, 1907	+	0
1867[3]	February 1, 1907	+	0
1867	October 31, 1907	+	+
1867	August 12, 1908	+	
1870	February 13, 1908	+	
1871	February 13, 1908	+	
1931	November 9, 1907	0	
1931	January 10, 1908	0	
1931	August 13, 1908	0	+
2069	February 11, 1908	+	0
2526	August 17, 1908	0	0
2527	August 17, 1908	0	0
2528	August 17, 1908	0	0
2529	August 20, 1908	0	+
2530	August 20, 1908	0	0
2531	August 20, 1908	0	+
2559	September 17, 1908	0	+
2559	October 15, 1908	0	
2560	September 17, 1908	0	+
2560	October 15, 1908	0	+
Plat 1	December, 1906	0	
" 2	December 13, 1906	0	
" 6	September 29, 1906	+	
" 7	October 29, 1906	0	
" 7	December, 1906	+	
" 9	October 10, 1906	+	
" 10	October 29, 1906	0	
" 10	October 31, 1907	0	0
" 12	September 10, 1906	+	
" 12	December, 1906	0	
" 13	September 29, 1906	0	
" 17	November 3, 1906	+	
" 17	December, 1906	+	

[3] Tested at least twelve times and never failed to nitrify but once.

These soils, with the exception of Nos. 1866, 1867, 1870 and 1871, are normal agricultural soils mostly from within a mile of the farm of the North Carolina Agricultural Experiment Station and are normally productive though not to be classed as rich soils. Nos. 1866 and 1867 are soils from the college green house. Nos. 1870 and 1871 are from commercial green houses of Raleigh.

For comparison, samples of soil were secured from New Jersey through Jacob Lipman, Washington, D. C., from Karl Kellerman, Michigan from W. S. Sayer and Wisconsin from H. L. Russell. It was requested that soils most promising as to nitrifying power be sent. It is seen from the following table that positive results were secured with each of these soils.

Soil	Date of Sampling	Results in:	
		Soil	Solutions
N. J. (H.)	September 28, 1908	+	+
N. J. (R. S.)	September 28, 1908	+	+
D. C. soil	September 28, 1908	+	+
Mich.	October 1, 1908	+	+
Wis.	October 1, 1908	+	+

The positive response of all of these soils and of our own green-house soil serves to doubly emphasize the fact that many of the soils here reported are really lacking in nitrifying power.

Further study of the quantitative results would emphasize still more the differences, since in many instances the soils which we have reported positively gave only a trifling amount of nitrate as compared with soils which are in vigorous nitrifying condition, *i. e.*, most of the soils which we report here as nitrifiers are, with the exception of Nos. 1866 and 1867, very poor nitrifiers as compared with 1866 or with the soils sent to us from distant sources.

While these data include various soils at various times of the year and under diverse climatic conditions, it is, of course, possible that some of the soils here recorded as non-nitrifiers would have induced nitrification if tested at some other time of the year; indeed there is positive evidence that in some instances soils change to a very marked extent in nitrifying power, but inasmuch as the tests here reported cover, in many instances, the period of crop production, their agricultural bearing would not be materially altered.

It is obvious that the absence of nitrifying power is a bacteriological condition that must be reckoned with in soil study. Upon its significance we are by no means ready to pronounce.

F. L. Stevens,
W. A. Withers

North Carolina Agricultural Experiment Station,
West Raleigh, N. C.,
December 8, 1908

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

ANTHROPOLOGY AT THE BALTIMORE MEETING

The joint meeting of Section H of the American Association and the American Folk-Lore Society was held at the Maryland Institute, Baltimore, December 28–31, 1908.

MEETINGS OF THE SECTIONAL COMMITTEE

In the absence of Professor R. S. Woodworth, vice-president of the section, Professor Boas, retiring vice-president, acted as chairman of the sectional committee. Officers of the Baltimore meeting were nominated as follows:

Member of the Council—B. T. B. Hyde.

Member of the General Committee—G. G. MacCurdy.

Sectional offices were filled by the nomination of Professor William H. Holmes, Washington, D. C., as vice-president for the ensuing year; Dr. George Grant MacCurdy, New Haven, Conn., secretary for five years; and Dr. Geo. A. Dorsey, member of the sectional committee, to serve five years. These candidates were later elected by the association in general committee. Professor W. H. Holmes was also elected president and Dr. George Grant MacCurdy reelected secretary of the American Anthropological Association, the proceedings of which are printed in the *American Anthropologist* for January–March, 1909.

ADDRESSES AND PAPERS

The address of the retiring vice-president, Professor Franz Boas, was on "Race Problems in America." "The Mythology of the Central and

Eastern Algonkins" was the subject of Professor Roland B. Dixon's presidential address before the American Folk-Lore Society. It will be printed in the first number of the *Folk-Lore Journal* for the current year.

The reports of several standing committees of the American Anthropological Association were of such general interest as to be in the nature of papers. That of the committee on archeological nomenclature, Dr. Charles Peabody, chairman, was ordered to be printed in full as a report of progress, as follows:

The following report has been prepared by Professor John H. Wright, Mr. J. D. McGuire, Mr. F. W. Hodge, Mr. W. K. Moorehead and Dr. C. Peabody, chairman. The recent illness and death of Professor Wright deprived the committee of his advice and suggestion during the final drafting; with this exception the report is unanimous.

To the President and Members of the American Anthropological Association:

The committee on nomenclature of specimens has the honor of submitting the following report; it covers only certain divisions of objects in clay and of objects in stone; the departments referred to seem to the committee to be peculiarly suited to a rigid examination resulting in definition, classification and naming.

In all the object of the committee has been to reduce everything to its lowest terms, to use English words, if possible, and words that shall be perfectly clear in denotation to scholars at home and abroad, and to adhere as closely as may be to classifications already made standard.

As has been well said, the difficulty in classification and nomenclature comes from our lack of complete and detailed knowledge.

The classifications here offered and the definitions here proposed in some detail are based, so far as is possible, on form alone. It is, of course, taken as an axiom that a classification based on form assumes no theory of the development, interrelation or conventionalization of forms or types in any manner whatsoever; it has been the particular aim of the committee to avoid or get rid of those classes and names that are based on uses assumed but not universally proved for certain specimens.

Should the attempt meet with the favor of the members of the association, it should be possible at a future date to apply the same principles to a detailed examination of other stone specimens and to specimens in shell, basketry and textiles, so far as has not been already done.

ARTICLES IN CLAY

Simple vessels in clay may be presumed to cover all forms except eccentric or conventionalized (*i. e.*, animal-shaped) forms, on the one hand, and discs and pipes on the other.

It is suggested by the committee that members of the American Anthropological Association having occasion to describe clay vessels may classify them: first, as to material, as consisting of clay, sand, shell and their combinations, and as possessing certain general ground-color; second, as to manufacture, as sun-dried or fired, as coiled or modeled—with the variations and steps of each process; third, as to form; fourth, as to decoration, as plain, stamped, incised or painted. With regard to form the committee begs to offer the following definitions and suggestions in classifications.

In all cases measurements are considered as referring to an upward direction.

A simple vessel must consist of a body and may have a rim, neck, foot, handle or any combination.

(1) Body: A formation capable of holding within itself a liquid or a solid substance.

(2) Rim: (A) A part of the vessel forming the termination of the body. (B) A part of the vessel recognizable by a change in the thickness of the material in the terminal sections.

(3) Neck: A part of the vessel recognizable by a more or less sudden decrease in the rate of increase or decrease of the diameter.

(4) Foot: An attachment to the vessel which serves as the support to the body when upright.

(5) Handle: A part of the vessel consisting of some outside attachment, not serving as support.

Body.—It is suggested that in comparing the forms or cross-sections of vessels particular attention be paid to the proportion of the diameter to the height, to the rate of change of this proportion, to the place of change of direction in this proportion and to refer to the following definitions of the two dimensions:

Height: The distance from the base to a horizontal plane passing through the most distant part of the rim.

Diameter: The distance from any one point on the sides to any opposite point on the sides measured on a plane at right angles to the height.

Base: The point of contact or a plane of contact of the body with a horizontal surface.

Types: Body.—These are so various, depending on relative height and diameter of the cross-section, that an analysis is too cumbersome to be of service to general reference.

Neck.
1. Expanding.
2. Cylindrical.
3. Contracting.
4. Combinations.

Lip.—A part of the neck or body recognizable by a suddenly increasing diameter of neck or body, that continues increasing to the rim.

Foot.—1. Continuous.
(A) Expanding.
(B) Cylindrical.
(C) Contracting.
(D) Combinations.

Feet.—2. Not continuous.
Differentiated by
(A) Number.
(B) Angle with the horizontal.
(*a*) Expanding upward.
(*b*) Perpendicular.
(*c*) Contracting upward.

Handles.—Types.
Differentiated by
1. Number.
2. Position on the vessel.
(A) Body.
(B) Neck.
(C) Foot.
(D) Combinations.
3. Form.
(A) Continuous with body or neck.
(B) Not continuous with body or neck.
(*a*) With constant direction.
(*b*) With varying direction.
(*c*) With reentry upon vessel.
(A′) Round.
(B′) Flat.
(C′) Coiled.

ARTICLES IN STONE

Chipped Stone

I. Knives and projectile points.
Larger = 5 cm. (2 inches) or more in length.
Smaller = less than 5 cm. (2 inches) in length.
Types.
1. Without stem.
(A) Without secondary chipping (=flakes).
(B) With secondary chipping.
(*a*) Pointed.
(*a′*) At one end.
Base concave.
Base straight.
Base convex.
Sides convex.
One side convex.
One side straight.
(*b′*) At both ends.
(*b*) Ends convex.
(*c*) More or less circular.
2. With stem.
(A) Stem expanding from base—with or without barbing.
(*a*) Base concave.
(*b*) Base straight.
(*c*) Base convex.
(B) Stem with sides parallel—with or without barbing.
(*a*) Base concave.
(*b*) Base straight.
(*c*) Base convex.
(C) Stem contracting from base—with or without barbing.
(*a*) Base concave.
(*b*) Base straight.
(*c*) Base convex.

Note 1. The proportion of the length of the base to its breadth should be observed.

Note 2. The notches in barbed specimens may be vertical, horizontal or with varying diameter.

Note 3. The angles formed by the faces (*i. e.*, "bevel") should be observed.

II. Scrapers.
Types.
1. With one or more scraping edges.
2. Without or with notch (including circular).

III. Perforators.
Types.
Differentiated by
1. Cross-section.
(A) Round.
(B) Quadrangular or irregular.
2. Stem.
(A) Without stem.
(B) With stem.
(*a*) Stem expanding gradually.
(*b*) Stem expanding suddenly.

IV. Hammerstones.
Types.
1. Spheroidal.
2. Discoidal.
(A) "Pitted."
(B) Not "pitted."
3. Elongated.
(A) Grooved.
(B) Not grooved.

Note 1. Practical or ornamental serration may be applied to many forms.

Note 2. Combinations of the types may appear in one specimen and any type may be infinitely varied by individual caprice.

Ground Stone

I. Problematical forms.
  1. Laminæ (*i. e.*, flat "spuds," "gorgets" and pendants).
    Types.
      (A) Spade-shaped.
      (B) Ovate.
        (*a*) Sides concave (not common).
        (*b*) Sides straight.
        (*c*) Sides convex.
      (C) Leaf-shaped.
      (D) Spear-shaped.
      (E) Rectangular.
        (*a*) Sides concave.
        (*b*) Sides straight.
        (*c*) Sides convex.
      (F) Shield-shaped.
      (G) Pendants.
        (*a*) Celt-shaped.
        (*b*) Rectangular.
        (*c*) Oval or circular.
  2. Resemblances to known forms.
    (A) Animal-shaped stones.
    (B) Boat-shaped stones.
    (C) Bar-shaped stones.
      (*a*) Longer, resembling true "bars."
      (*b*) Shorter, "ridged" or "expanded gorgets."
    (D) Spool-shaped stones.
    (E) Pick-shaped stones.
    (F) Plummet-shaped stones.
    (G) Geometrical forms.
      (*a*) Spheres.
      (*b*) Hemispheres.
      (*c*) Crescents.
      (*d*) Cones.
  3. Perforated stones with wings.
    (A) Wings with constant rate of change of width.
      (*a*) Wings expanding from perforation.
      (*b*) Wings with sides parallel.
      (*c*) Wings contracting from perforation.
    (B) Wings with varying rate of change of width.
II. Tubes and tube-shaped stones.
III. Beads.
IV. Pitted stones other than hammer-stones.

The committee finally takes pleasure in thanking the following members for assistance rendered:

Professor N. H. Winchell, University of Minnesota, Minneapolis; Professor Henry Montgomery, University of Toronto, Toronto; Professor Wm. N. Bates, University of Pennsylvania, Philadelphia; Dr. H. Kinner, St. Louis, Mo.; Dr. George Grant MacCurdy, Yale University, New Haven; Mr. W. Raymond Harrington, New York; Mrs. Zelia Nuttall, Coyoacan, D. F., Mexico; Mr. C. C. Willoughby, Harvard University, Cambridge; Dr. Walter Hough, National Museum, Washington; Dr. Nicholas León, Mexico; Mr. F. S. Dellenbaugh, New York; Professor F. W. Putnam, Harvard University, Cambridge; Dr. John M. Wulfing, St. Louis; Mr. H. I. Smith, American Museum of Natural History, New York; Rev. J. D. Marmor, New York; Mr. Christopher Wren, Plymouth, Pa.; Dr. A. W. Butler, Indianapolis; Dr. H. W. Shimer, Boston; Professor W. H. Holmes, Washington; Mr. Richard Herrmann, Dubuque, Iowa; Dr. H. F. ten Kate, Tokio; Dr. J. B. Ambrosetti, Buenos Aires.

The committee was continued and asked to collate the terminology already in use.

The report of the Committee on Concordance of American Mythologies was accepted as read by Professor Boas, chairman, and the committee was continued.

Mr. F. W. Hodge's report as chairman of the Committee on Linguistic Families North of Mexico was accepted and the committee continued. In this connection it was moved and carried that whenever an author uses a term not acceptable to the committee the editor be instructed to add in parenthesis the term approved by the committee. Mr. Hodge also reported for the Committee on Book Reviews, of which he is chairman. The report was accepted and the committee discharged at their own request and with a vote of thanks for their labors on the part of the association.

Dr. George A. Dorsey, recently returned from a year's stay in the far east, gave an interesting account of his journey through New Guinea. The Papuans of New Guinea are very different physically from the natives of New Britain. The various forms of head-dress were described; also the splendid character of the pile dwellings that are such a striking feature of the coast region. Mention was made of the wooden drums five to fifteen feet in length, great adzes of stone and shell, wooden bowls carved to represent animals, the canoes, etc. All are expert canoe men. The usual form is the outrigger carrying sails and often of great size.

The Big River (Kaiserin Auguste) was ascended for a distance of 110 miles, where it was still as large as and deeper than the Mississippi at St. Louis. The country is flat and covered by extensive forests. Twenty villages (sago gatherers)

were passed. The sago palm is cut down near the ground and the top lopped off; the trunk is split and the mass of sago broken up by means of a cylindrical stone set as an adz. The houses differ from those along the coast. They are built on piles, to be sure; instead of being squarish, they are long, narrow and absolutely open at each end. This is to provide ventilation, as the natives sleep in long mosquito-proof, tightly woven rattan bags. There is usually an altar with human images. Human skulls (of relatives) are placed on the floor in front of these altars. The canoes are carved at one end to represent the alligator.

"Geological Facts bearing on the Place of the Origin of the Human Race" was the title of a paper by Professor George Frederick Wright. It is becoming more and more clear that the glacial period was ushered in by a general land elevation over all the northern hemisphere (if not the whole world). All the high mountains of the world bear Tertiary strata at elevations of several thousand feet. The effect of such elevation would be to enlarge the continental area around all their borders and form land connection between northwestern America and northeastern Asia and possibly between Greenland and northern Europe. It would also connect North America with South America through the West Indies, and Europe with Africa across the Straits of Gibraltar and the shallow belt extending south from Sicily. That there was such a land connection appears from the fact that at the close of the Tertiary period, as the glacial epoch was approaching, there was a remarkable intermingling of the fauna of these connected regions. The elephant and rhinoceros came over from Africa and wandered as far north as Yorkshire, England. The megalonyx and some other South American species wandered into North America as far as Ohio, while the mammoth spread from central Asia across Siberia to northwestern America and wandered to the Atlantic coast and borders of Mexico.

Cumulative evidence seems to point to central Asia as the center from which man was dispersed in company with the mammoth over the entire northern hemisphere. Central Asia seems to have been the earliest center of civilization. Here in the ancient valley of the Oxus, according to Pompelly, there are ruins of cities which reach back to 8000 B.C., and here, beyond reasonable doubt, the Aryan family of languages had its origin.

A study of the physical changes which passed over this region contemporaneously with those in northern America and Europe during the glacial period and the now undoubted connection of man with the glacial period, render very plausible the hypothesis that the changes connected with that period were a contributory cause of the dispersion of mankind from this Asiatic center. Recent investigations show that, during the glacial period, central Asia offered a specially favorable area for the development of man together with both the vegetable and animal species upon which he is dependent for means of sustenance. The whole region is dependent upon irrigation, which is secured by the flow of water which comes down from the melting ice and snow on the lofty mountain heights. At the present time this irrigated belt is a very large one, but during the glacial period when the ice came several thousand feet lower down on the mountains (but never to the plains), the irrigated areas were immensely larger, furnishing sustenance for an indefinitely larger population. But at this time all northern Europe and northern America were enveloped in glacial ice. But as the glacial period declined the supply of water from the mountains of central Asia diminished and the oases contracted so as greatly to curtail the field of human occupation. Contemporaneously with this curtailment in central Asia the fertile plains of Europe and North America were opened to occupation by the melting of the ice, so that streams of emigration entered both Europe and North America from this common center. In America the Aryan-speaking races are just entering upon this glacial inheritance. It certainly means a great deal in the settlement of the question of the origin of the human race that we have so many classes of facts pointing to this conclusion or at least coinciding with this theory.

Professor Wright also presented for inspection three implements recently found, supposed to be of glacial age. The first was one already described by Miss Luella A. Owen in the sixth volume of "Records of the Past." The evidence is perfectly satisfactory that it was found in undisturbed loess at St. Joseph, Mo., thirty feet or more below the surface. The second was found in the bottom of a pit where the loess was being excavated two or three miles above St. Joseph, and in all probability came from the loess. Both these implements are of paleolithic type and the patina upon them and the oxidation of the surface indicate great age. The third implement, which is of a familiar paleolithic type, was found in a gravel pit excavated in a "kame terrace" on the border of the River Styx in Wadsworth, Medina County, Ohio. But it was found on the floor of the pit so that the evidence is not definite

as to its position in the undisturbed gravel, but everything about it is consistent with its glacial age and it is different in almost every respect from the great number of implements found on the surface in that locality. Its character is confirmed by the fact that in a farmer's collection near by another implement almost precisely like it was found and reported to have been from this same gravel deposit a short distance away.

"Characteristic Traits of the Yana Language of California." The Yana language of northern California represents a distinct liguistic stock and was spoken in three dialects (north, central and south), of which one (south) is now extinct. Phonetically it is characterized by the presence of intermediate, aspirated surd and "fortis" stops, by a weakly trilled r, by voiceless l, m, n and r, and by doubled (long) l, m and n. Phonetic processes of morphological significance are vocalic changes in the verb stem in the formation, *e. g.*, of causatives and passives, and the change of l to n in nouns to form the diminutive.

There are two main forms of speech in Yana, one used by men speaking to men, the other in all other cases; the second form is differentiated from the first partly by phonetic, partly by formal modifications. Morphologically Yana is characterized by having practically only two parts of speech—noun and verb (adjectives, numerals, interrogative pronouns and adverbs, and conjunctive elements are all morphologically verbs). The pronominal elements (possessive and subject) are, in the main, identical in both noun and verb, a grammatical differentiation of these parts of speech being brought about largely by syntactic means. The structure of the verb is rather complicated. Besides pronominal suffixes and tense and mode suffixes, all of which are more strictly formal in character, we have stems of first position, which may, in many cases, be directly employed with the requisite formal suffixes, stems of second or other position, which can not be used without a preceding stem of first position, and an immense number of derivational suffixes (local, temporal, relational, quasi-modal, etc.). The total number of non-formal elements that follow stems of first position is easily over three hundred. Prefixes do not occur in Yana.

Mrs. Zelia Nuttall spoke of "A Curious Survival in Mexico of the Use of *Murex purpura* for Dyeing Purposes," producing by way of demonstration two woven fabrics colored purple. The industry is known to exist in Nicoya, Costa Rica. Hartman found it also on the Peninsula of Guanacosta (Costa Rica).

Drs. Charles Peabody and George Grant MacCurdy made a "Presentation of Eoliths from Boncelles," near Liège, Belgium, they having visited that station together last summer. Boncelles lies in the Ardennes at a height of 265 meters above the sea. Here M. de Munck discovered eoliths in a flinty layer surmounted by a thick deposit of upper Oligocene sands. The age of the latter is determined by numerous fossil shells, including *Cytherea beyrichi*, *Pectunculus obovatus* and *Cardium*. According to Rutot the deposit in which the eoliths occur is of middle Oligocene age. The Boncelles eoliths are therefore older than those of Cantal.

Another paper dealing with European archeology, "Some Recent Paleolithic Discoveries," was presented by Dr. George Grant MacCurdy. This paper appeared in the October–December issue of the *American Anthropologist*.

The papers by Dr. C. Hart Merriam: "Mythology of the Mewan Tribes," "Additional Notes on the Yumme or Mourning Ceremony," "The Creation Myth of the Pá-we-nan" and "Battle of the First People with Dakko, the Sun God—a Hamfo Myth," will appear in the *Journal of American Folk-Lore*.

Mr. Stansbury Hagar discussed "Izamal and its Celestial Plan." At Izamal in the north-central part of Yucatan are found a group of ruins which mark the site of an ancient theogonic center of the Mayas. Landa, writing in the latter half of the sixteenth century, gives the earliest reference to them. He mentions eleven or twelve edifices and describes one. Lizana, writing sixty years later, found only five edifices, but he gives us a detailed description of their comparative location and of the traditions associated with them which reveals the basic plan of Izamal. This plan is confirmed by details supplied by the modern travelers, Stephens, Norman, Charnay, Le Plongeon and Holmes.

Lizana says that the buildings were temples; they stood upon the summit of pyramidal mounds typical of Mexico and Central America, as well as Yucatan. Towards the north was the highest temple, called Kinich Kakmo, Sun-Eye and Ara or Parrot of Fire, because the sun was supposed to descend upon it at noon and to consume the offerings upon its altar, as the fiery plumed ara descends from the sky. These symbols were associated with the time of the June solstice.

The Mayan ritual refers to the descent of an "angel" upon the altar at this time and to the new fire festival. A similar Mexican tradition mentions the descent of a bird in a luminous

constellation. The symbolism therefore seems to refer to the annual descent of the sun from the sign Cancer, the northernmost point in the solar journey, at the solstitial noon of the year.

Towards the west was the mound and temple dedicated to Itzamna as lord of the dead. It contained the image of a hand, because on this spot Itzamna healed those who were ill and restored the dead to life by laying his hand upon them, whence it bore the name Cab-ul the Working Hand. In this aspect Itzamna may be identified with the death god A of the codices who rules the Mayan uinal Xul or End in October–November and represents Scorpio, the death sign.

Towards the southwest was the temple of Hunpictok, the Warrior, or the Commander of Eight Thousand Lances. This was an arsenal and the headquarters of the army. Beside one of the two colossal heads upon the facade of this pyramid may still be seen the double spiral xonecuilli symbol which connoted the sign and constellation Sagittarius for the Mexicans. It also referred to the gods of war, and to Orion the Warrior, who represented Sagittarius as a catasterism.

At the south stood the temple of Itzamna in the aspect of the Cosmic Spirit, represented in the codices by the god D and the sign Capricornus.

Finally Lizana describes the temple called Papp Hol Chac, House of Heads and Lightnings. He does not locate it, but Charnay writes of it as facing the Kinich Kakmo pyramid from the south. In it dwelt the priests who administered justice and foretold the future. Apparently the reference is to the tlahtouani or diviner of the Mexicans, Maya chilan, who imparts the wisdom supposed to be obtained from the spirits of the dead, and who is associated with the constellation Teoyaotlatohua, our Libra-Scorpio. In this instance the former sign seems to be represented. Lizana also mentioned four roads which extended from Izamal towards the cardinal points.

Each of the five edifices described by Lizana was associated with a zodiacal sign. Their relative positions correspond correctly to those of the signs they represent. The original plan of Izamal consisted of twelve temples each representing a zodiacal sign in its proper relative position in the zodiacal circle. These structures were grouped around an undefined central space from which the four roads divided the country into four provinces corresponding to the celestial and cosmical quartering of the solar path by the solstices and equinoxes. The basis of this plan was therefore the imitation upon earth of the supposed celestial plan. It is identical with the plan of Cuzco, the Inca capital,[2] a plan most appropriate to a sacred city of priests who watched the stars. The Izamal symbols repeat throughout those of Peru, indicating intercommunication, direct or indirect, between the Mayas and the Peruvians at some time.

In "Social Institutions of the Tinglayan Igorrotes," Mr. Daniel Folkmar gave some of the results of his work for the Ethnological Survey of the Philippine Islands while Lieutenant Governor of Bontoc.

The following papers were read by title:

Measurements of Mixed and Full-blooded Dakota Children: Dr. Clark Wissler.

Height in the American Indians: Dr. Alës Hrdlička.

Memorial Address for Otis T. Mason: Dr. Walter Hough.

Archeological Explorations in Manitoba: Professor Henry Montgomery.

Some Inventions of the Ancient Hawaiians: Mr. William A. Bryan.

Committee Report on the Preservation of American Antiquities: Dr. E. L. Hewett (Secretary).

Ballads and Songs of Western North Carolina: Miss Louise Rand Bascom.

Folk-Lore from the Southern States: Dr. John P. Cross.

Folk-Music in America: Mr. Phillips Barry.

Notes on the Northern Wintun Indians: Mr. F. B. Washington.

Traditions of the Coos Indians of Oregon: Mr. Leo Forchbenberg.

Observations on Esoteric Narratives on the Source of Myths: Dr. Clark Wissler.

Sketch of the Yuchi Language: Dr. Frank G. Speck.

Songs of the Western Cowboys: Mr. George Will.

The Importance of Recording Negro-Lore, Dialects and Melodies: Miss Mary W. F. Speers.

George Grant MacCurdy,
Secretary

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
SECTION K—PHYSIOLOGY AND EXPERIMENTAL MEDICINE

SUMMARY OF THE PROCEEDINGS

There were two meetings of the section in the auditorium of the physiological building at the Johns Hopkins Medical School during convocation week, as follows:

[2] See author's paper on "Cuzco, the Celestial City," in *Proceedings of the International Congress of Americanists*, New York, 1902.

First Session.—Tuesday afternoon, December 29, 1908. Presiding officer: Vice-president William H. Howell. The program consisted of: (1) an address by the retiring vice-president, Ludvig Hektoen, on Opsonins and other Antibodies,[1] and (2) a symposium on The Regulation of Physical Instruction in Schools and Colleges from the Standpoint of Hygiene.

Second Session.—Wednesday afternoon, December 30, 1908. Presiding officer: Vice-president William H. Howell. Joint session with the American Physiological Society, the Society of American Bacteriologists and the American Society of Biological Chemists. This session was devoted to three *general* papers (see scientific proceedings below).

EXECUTIVE PROCEEDINGS

The following officers were elected for the ensuing term:

Vice-president of the Association and Chairman of the Section—Charles Sedgwick Minot.

Secretary—George T. Kemp.

Sectional Committee—William H. Howell, vice-president, 1908–9; Charles Sedgwick Minot, vice-president, 1909–10; George T. Kemp, secretary, 1909–13; Frederick G. Novy (one year), Graham Lusk (two years), Jacques Loeb (three years), E. P. Lyon (four years), William J. Gies, secretary 1904–9 (five years).

Member of the Council—W. G. MacCallum.

Member of the General Committee—William W. Ford.

SCIENTIFIC PROCEEDINGS

I. FIRST SESSION.—(1) Vice-presidential address and (2) symposium on college athletics.

Program

Address by the retiring chairman, Dr. Ludvig Hektoen, professor (and head of the department) of pathology and bacteriology, University of Chicago. Subject: Opsonins and other Antibodies.[2]

Symposium—Subject: "The Regulation of Physical Instruction in Schools and Colleges from the Standpoint of Hygiene."

Introductory remarks by the chairman, Dr. William H. Howell, professor of physiology, and dean, Johns Hopkins Medical School.

The Regulation of Physical Instruction in Schools and Colleges from the Standpoint of Hygiene: Dr. R. Tait McKenzie, professor of physical education, University of Pennsylvania.

On the Physiological Effects of Moderate Muscular Activity and of Strain: Dr. Theodore Hough, professor of physiology, University of Virginia.

Physical Exercise from the Standpoint of Physiology: Dr. Frederic S. Lee, professor of physiology, Columbia University.

Departmental Organization for the Regulation of Physical Instruction in Schools and Colleges from the Standpoint of Hygiene: Dr. Thomas A. Storey, associate professor and director of physical instruction, College of the City of New York.

General discussion.

II. SECOND SESSION.—General papers in joint session with the American Physiological Society, the Society of American Bacteriologists and the American Society of Biological Chemists.

Program

Anaphylaxis: Dr. M. J. Rosenau, director of the hygienic laboratory, Public Health and Marine Hospital Service, U. S. A., Washington.

The Physiological Significance of Creatin and Creatinin: Dr. Lafayette B. Mendel, professor of physiological chemistry, Sheffield Scientific School, Yale University.

The Venous Pulse: Dr. Albion W. Hewlett, professor of the theory and practise of medicine and clinical medicine, University of Michigan.

General discussion.

PAPERS AND ABSTRACTS (I. AND II.)

I. Papers comprising the symposium on The Regulation of Physical Instruction in Schools and Colleges from the Standpoint of Hygiene. By Drs. Mackenzie, Hough, Lee and Storey. (To be published in SCIENCE, March 26 and April 2.

II. Papers comprising the program of the joint session with the bacteriologists, biochemists and physiologists. By Drs. Rosenau, Mendel and Hewlett.

Anaphylaxis: M. J. ROSENAU. (Will be published in the *Archives of Internal Medicine.*)

The Physiological Significance of Creatin and Creatinin: LAFAYETTE B. MENDEL. (Will be published in SCIENCE.)

The Venous Pulse: ALBION WALTER HEWLETT.

The typical venous pulse consists of three main waves which have been designated the *a*, *c* and *v* waves, respectively. A comparison of the jugular pulse with that of the carotid artery shows that the *c* wave occurs almost simultaneously with the carotid pulse. The *a* wave precedes the *c* wave

[1] See SCIENCE, Vol. XXIX., p. 241, 1909.

[2] See SCIENCE, Vol. XXIX., p. 241, 1909.

by an interval of about 0.18 second. It is caused by the contraction of the auricle. In some tracings the *a* wave is very prominent, greatly overshadowing the succeeding *c* wave. This was noted particularly in patients with more or less decompensation, though it is not pathognomonic of such conditions.

The *c* wave occurs almost simultaneously with the carotid pulse and in some instances it is caused by a transmitted arterial pulsation. The earlier writers, especially Francois Franck, Fredericq and Gerhardt regarded the *c* wave as a true venous wave, but Mackenzie and Wenckebach believe that it is always a carotid pulse. Recent investigations, however, tend to show the correctness of the earlier views; for, (1) the *c* wave can often be recognized by inspection as being present in the veins themselves, (2) it often precedes the carotid pulse by about 0.02 second, (3) it has a different form, (4) it can occasionally be demonstrated on liver tracings, and (5) in pathologic venous tracings, especially from cases of auricular paralysis, the *c* wave on the jugular differs in size from the radial pulse, often being largest when the radial is smallest. In most tracings, therefore, the *c* wave is of venous origin; when of arterial origin, this is generally indicated by its form.

The venous *c* wave is probably to be referred back to the momentary increase in intra-auricular pressure which occurs at the onset of ventricular systole. This wave of increased pressure appears somewhat later in the neck on account of the slow transmission of venous waves.

The negative wave following the *a* wave is undoubtedly due to auricular diastole. That following the *c* wave may also be explained in part by auricular diastole; but it is evident (1) from heart block tracings and (2) from tracings of auricular paralysis from man and from animals that ventricular systole alone is capable of causing a negative wave in the venous pulse just after the *c* wave. This is caused by the descent of the ventricular base during systole, which opens up the auricle on its attachments to the great veins.

Tracings from a patient with palpitation showed a very marked *c* wave and a very marked depression immediately following. As other venous waves were merely indicated on the tracing, it seems probable that the earlier movements of the ventricle during systole were executed with unusual speed.

The *v* wave appears in the neck just after the time of the dicrotic notch on the arterial pulse. Owing, however, to the slow transmission of venous waves the *v* wave begins in the heart at a somewhat earlier period, probably in late systole, and it is terminated there by the opening of the tricuspid valves. It is probably due partly to a replacement of the base of the ventricle toward the auricle at the onset of diastole. It is also due in part to the accumulation of blood in the auricle during the closing of the tricuspid valves. The *v* wave is accentuated in conditions of auricular stasis especially in tricuspid insufficiency and auricular paralysis.

The negative wave following the *v* wave is due to the opening of the tricuspid valves and the consequent flow of blood toward the ventricle. It is especially pronounced in conditions of auricular stasis. In slowly acting hearts this negative wave is often followed by a shoulder on the venous tracing which seems to be due to a recoil from the rapid filling of the ventricle.

William J. Gies,
Secretary

SOCIETIES AND ACADEMIES

THE WASHINGTON ACADEMY OF SCIENCES

Dr. Alfred G. Mayer, of the Carnegie Institution of Washington, delivered an address before the Washington Academy of Sciences Tuesday evening, February 23, on "The Tortugas Marine Laboratory, its Scope and Aims." Dr. Mayer kindly furnished the following abstract of his address:

"The lecturer called attention to the fact that this laboratory is the only permanent marine station within the American tropics, and that the generous support accorded to it by the Carnegie Institution of Washington had enabled it to develop into the best equipped marine laboratory in the tropical world.

"The seven Tortugas Islands are out in the Gulf of Mexico, seventy miles west of Key West, and consist of coarse wave-washed and wind-blown fragments of marine shells, which afford no soil suitable for the growth of mangroves; and thus the laboratory is unique in being the only place on the seaboard of Florida which is free from endemic mosquitoes in summer.

"Along the mainland coast of southern Florida the winds cause the waters over the coral flats to be churned into a silky mass of suspended silt, which is fatal to pelagic life, but at Tortugas, owing to the great area of deep ocean water in their neighborhood and the small size of the coral

plateau around them, this is not the case. The islands lie on the leeward side of the Gulf Stream, and the rich pelagic life of the great tropical current is constantly drifted upon their shores.

"Expeditions have for generations brought tons of preserved specimens of tropical forms home to our museums and colleges, where they have been studied and named, but as yet we know sadly little of the *living* animals of the tropics, their habits, development and physiology. The laboratory, therefore, aims chiefly to encourage research in these new fields, and to this end many of our leading investigators and most promising young workers in research have been invited to pursue their studies at Tortugas.

"The laboratory is now entering upon its fifth year. Two volumes of its researches have been published by the Carnegie Institution, and ten other papers have been published in various scientific journals, and the amount of research work now in press greatly exceeds that yet published.

"The lecturer then reviewed some of the more generally interesting, although not necessarily the most important, researches, as follows: The late Professor William K. Brooks, of Johns Hopkins University, carried out interesting studies of the pelagic *Solfæ* of the Tortugas, his papers being excellently illustrated by the drawings made by Mr. Carl Kellner. Brooks and McGlove find that the lung of the prosobranchiate gasteropod *Ampullaria* is developed out of a thickening, or ridge, of the epithelium of the mantle, and arises simultaneously with the gill and osphradium, all three being homologous organs. There is probably no phylogenetic relationship between the lung of *Ampullaria* and that of the pulmonates. *Ampullaria* is a large brown snail which lives in the fresh water of the Everglades, and lays eggs in pearl-like clusters on the stems of grasses above the water-line.

"Mr. Frank M. Chapman, of the American Museum of Natural History, describes the nesting habits of the booby (*Sula leucogastra*) and of the frigate bird (*Fregata aquila*) upon the isolated rocky island of Cay Verde in the Bahamas. Permission to study these birds was generously granted by his excellency, Sir William Grey-Wilson, in his official capacity as governor-in-council of the Bahamas. Specimens for a 'group' of the frigate birds were collected and these are now beautifully displayed in the American Museum in New York. Mr. Chapman found the nesting season of both boobies and frigate birds to be at its height early in April, the birds having apparently come to the island to nest in February. He found that the boobies always lay two eggs, but rear only one young bird.

"Professor Edwin G. Conklin, of Princeton University, studied the structure of the egg of the 'thimble jellyfish,' *Linerges mercurius*, which appears in vast breeding swarms upon the surface in the spring at Tortugas, and the Bahamas. He discovered that these medusæ always spin in an anti-clockwise direction as they progress through the water if viewed from the oral pole. The eggs consist of three easily distinguished substances. A peripheral layer of clear protoplasm which becomes the peripheral layer of the embryo and gives rise to the cilia, an intermediate layer of closely crowded yolk spherules which constitute the principal parts of all of the cells of the gastrula and blastula, and an inner mass of dissolved yolk which is poured into the cleavage-cavity and probably serves as a source of nourishment.

"Dr. R. P. Cowles, of Johns Hopkins, made an elaborate study of the habits of the 'ghost crab,' *Ocypoda arenaria*, and finds that it probably can not distinguish color as such but detects simply a difference between light and shadow. It can form simple associations and displays memory. It has apparently no sense of hearing, but its otocysts are organs of equilibration. It changes color under the influence of light and temperature, but this change does not occur if the crab's eyes be blackened.

"Dr. H. E. Jordan, of the University of Virginia, carried out a very elaborate series of studies upon the histological structure of the eggs of echinoderms and of the walking-stick-insect, *Aplopus*. The germinal spot in echinoderm eggs appears to be in part at least a storehouse of material which is to contribute in the formation of the chromosomes. He finds in *Asterias* and *Hipponoë* that the chromosomes do not arise out of the nucleolus, but the latter contribute nutritive substance to them. In the walking-stick-insect, *Aplopus*, he finds that half of the spermatozoa have eighteen, and half seventeen chromosomes, and the accessory chromosome is large and U-shaped and probably determines the female sex.

"Dr. Charles R. Stockard, of the Cornell Medical College, and Dr. Charles Zelemy, of Indiana University, found, working independently, that in the scyphomedusa *Cassiopeia xamochana* removing a greater number of the mouth-arms causes each and every arm to regenerate faster. Stockard finds also that although regeneration of each and

every arm is more rapid the greater the number of arms removed yet this regeneration is carried on at the expense of the normal body tissues which shrink while the arms grow, thus recalling the case of cancerous growths which, having more ability to absorb nutriment than the normal body tissues, grow at the expense of the body itself. Stockard finds also that the nearer the cut surface is to the center of the disk of the medusa the more rapid the regeneration. He finds that regeneration is somewhat retarded by a slight excess of NaCl, very much retarded by $CaCl_2$, but not appreciably affected by Mg. A slight excess of KCl accelerates, and a strong excess retards regeneration. Zeleny, working upon the gulf-weed crab, *Portunus sayi*, finds that successive removals of appendages neither increase nor decrease the rate of regeneration of the successively removed part.

"An interesting series of observations were carried on by Dr. Stoddard in which he shows that the habits of the walking-stick-insect, *Aplopus*, accord perfectly with the general resemblance of the animal to a stick. He discovered that the males will mate with the cut-off terminal part of the female's abdomen if this be mounted upon a stick.

"Professor Jacob Reighard, of Michigan University, investigated the problem of 'warning coloration' in so far as it affects the brilliantly colored reef fishes and their enemies, and he shows conclusively that these brightly colored fishes are at once greedily devoured if they leave the shelter of the coral reefs. The commonest predatory fish of the Tortugas, the gray snapper, *Lutianus griseus*, can, however, be *taught* to avoid a fish rendered artificially distasteful, and will remember its experience and still avoid the possible prey for at least twenty days after it has had the evil experience of attempting to devour such a fish. The coral-reef fishes are, therefore, *not* warningly colored, yet warning color *could* exist, but apparently it does not in nature; at least in so far as the reef fishes experimented with are concerned.

"Professor John B. Watson, of Johns Hopkins University, remained for three months upon Bird Key, Tortugas, studying the reactions of the noddy (*Anodus stolidus*) and sooty (*Sterna fuliginosa*) terns. This work was conducted under conditions of great inconvenience, for the temperature of the air under the bushes is commonly 123° F. at noon. Professor Watson found about 1,400 noddies, and 18,800 sooties nesting upon this little island not a quarter of a mile wide. While the noddy is building its nest in the bushes early in May it is very shy, but as soon as the egg is laid its habits change and it will remain and defend the egg. If, however, an egg be artificially placed in an unfinished nest the habits of the birds at once change and they settle down upon the egg and defend it. They do not recognize their own eggs, and will sit upon hens' eggs, sooty terns' eggs, their own eggs painted red, green or black, or an artificially egg-shaped piece of magnesium sulphate. The sooty tern, however, will not usually accept colored, or strange-looking eggs. The noddies relieve each other on the nest at intervals of about two hours, the new-coming bird crowding the sitting mate off the nest.

"The sooty tern makes its nest upon the ground. It is greatly confused and may lay a new egg if the egg be moved twenty-two inches horizontally from the original place, but the egg may be raised or lowered many feet in a vertical direction and the bird alights upon it at once apparently undisturbed.

"The young birds of both species can be taught to go through a labyrinth for their food; and the old sooties can learn to go through a maze to their egg, or to open a cage to obtain access to the egg. Neither of these birds is in the habit of going more than about seventeen miles from the island for their supply of fish, yet when they were taken away in the holds of vessels and liberated at Key West, Havana and Cape Hatteras they returned to the island. In the case of the sooties, the return from Cape Hatteras to Bird Key was made in five days, the straight-line distance being 850 and the 'along-shore' route 1,081 statute miles. There are many other important observations recorded in Professor Watson's paper.

"The lecturer expressed regret that limitations of time prevented his presenting before the academy the results of other interesting studies which had been conducted by investigators at Tortugas, but would refer his audience to the papers of Jennings, Linton, Perkins and others who had published accounts of their researches at the laboratory."

The paper was discussed at considerable length by C. Hart Merriam, Austin H. Clark and T. S. Palmer, who heartily commended the work of the Tortugas laboratory, and referred to similar laboratories and their work in various parts of the world.

J. S. Diller,
Recording Secretary

THE PHILOSOPHICAL SOCIETY OF WASHINGTON

THE 661st meeting was held on February 27, 1909, Vice-president Abbot in the chair. The following papers were read:

The Relation between Sky Polarization and the General Atmospheric Absorption: Mr. H. H. KIMBALL.

Rayleigh has shown that sky polarization may be attributed to the presence of particles in the atmosphere whose diameters are small as compared with the wave-length of light, and the researches of Barus indicate that such particles must be "an integrant part of the air" and "could scarcely be separated from it except by filtration." We can not, therefore, expect marked fluctuations in the intensity of the polarized component of sky light.

On the other hand, the intensity of the unpolarized component will vary with the amount of light scattered by particles in the atmosphere whose diameters are large as compared with the wave-length of light, and with the amount reflected from the surface of the earth and from clouds.

Eliminating reflection from clouds, and allowing for variations in the reflection from the earth's surface, there remains as a variable factor the scattering of light by large particles in the atmosphere.

The intensity of the unpolarized component of sky light should, therefore, be a function of the number of such particles present, and consequently of the general absorption or diffusion of light by the atmosphere.

From observations with an Angström pyrheliometer and a Pickering polarimeter at the Central Office of the Weather Bureau, an empirical equation has been developed showing the relation between sky polarization and the general atmospheric absorption. By means of this equation polarimeter observations are now employed to check the computations of the value of the solar constant from readings of the pyrheliometer and the psychrometer by a method shown in Bulletin of the Mt. Weather Observatory, Pt. 4, Vol. 1. The results indicate a close relation between sky polarization and the general atmospheric absorption.

The Principles of Machines for Liquefying Gases: Dr. EDGAR BUCKINGHAM.

The speaker discussed the principles involved in the action of simple liquefying machines as distinguished from cascade processes with one or more precooling stages. The total cold available depends only on the pressures between which expansion takes place and the initial temperature of the gas; and with the ordinary type of liquefier is quite independent of the internal arrangement of the apparatus. The fraction of the gas that can be liquefied may be computed from its thermal and mechanical properties, if these are known; and the computed values agree very closely with those found by experiment. The increase in yield attainable by avoiding part of the dissipation within the liquefier may also be computed, and is very considerable. Methods for obtaining this improved yield were discussed briefly.

R. L. FARIS,
Secretary

THE ACADEMY OF SCIENCE OF ST. LOUIS

THE regular meeting was held on Monday, February 1, 1909, at the academy building, 3817 Olive Street, the program of the evening having been especially arranged in celebration of the centenary of the birth (February 2, 1809) of Dr. George Engelmann, one of the founders of the academy, and its first president. Standing not only among the leading medical practitioners of the last generation, Dr. Engelmann was also one of the foremost botanists of his day; for, during the many years of an active, useful life, most of which was spent in St. Louis, he found sufficient time, in the leisure hours of his practise, to devote to a series of most valuable scientific investigations. And, moreover, in addition to his professional and botanical labors, he was a zealous meteorological observer, keeping observations pertaining to atmospheric phenomena for over forty years.

Dr. Baumgarten opened the program of the evening with a very interesting paper, entitled "The Personality of Engelmann." And Dr. Baumgarten, having been a personal friend of the physician and botanist, was peculiarly well fitted to handle this subject, which he treated in a reminiscent way, making characterizations of a personal rather than mere biographical nature. This tribute of Dr. Baumgarten to the memory of his friend was one that bespoke only the most sincere friendship for Dr. Engelmann, and the highest appreciation of his character and achievements.

Professor H. A. Wheeler presented a paper on "Engelmann's Contributions to Geognosy." For Engelmann's reputation extended beyond the borders of his master work in botany and his devotion to local meteorology; although his influence in geognosy is perhaps due less to actual work done in that field than to the stimulation

he inspired in specialists of that department. In 1859 he published a paper that concerned itself with the elevation of St. Louis above sea level, which, aside from its general interest and scientific value, was especially important in that St. Louis was then the point upon which were based the computations for determining the altitudes of such places in the far west as were visited by the early exploring expeditions of Nicollet, Fremont, Owen and Emery. Engelmann, after a series of barometric observations in 1853, determined a directrix of 404.9 feet for the city of St. Louis—a figure which differed by only 7.8 feet from the later 412.7 feet mark as determined by precise leveling of government deparments, and by only 2.2 feet from the original 410.5 of Nicollet which was made in 1841 by barometric determinations based upon data furnished by Engelmann himself. While the contributions of Engelmann seem slight when compared with his masterly work in botany and meteorology, they are, nevertheless, a valuable index of the breadth of the man, of the keen interest he took in the natural sciences, and of his mental caliber and scientific training.

Professor Nipher, of Washington University, in a paper, "Engelmann's Work in Meteorology," told how Engelmann began his meteorological observations when he first settled in St. Louis, and how he continued them for nearly fifty years. Dr. Nipher explained how this long series of observations enables us to determine the normal rainfall and temperature for St. Louis, and how they, in turn, are useful in fixing extremes of temperature and rainfall. In 1861, Engelmann published the results of his rainfall observations, which show that June is by far the month of greatest precipitation; and he pointed out that the June rise in the Mississippi is not due to the melting of snows in the mountains, but to heavy and wide-spread spring rains. The fact that Engelmann gave attention to the rate of rainfall is noteworthy because that is a quantity which must be considered in the design of bridges and other structures that are to carry flood water. After remarking that Engelmann made an early study of the differences of temperatures and humidity in the city and in Shaw's Garden (which was, he said, on an open prairie three miles from the city), Dr. Nipher concluded with the statements that Engelmann was continuously in cooperation with the weather service in charge of the Smithsonian Institution, and that in many ways his aid was solicited by government officials in charge of work in the far west.

Dr. Trelease, of the Missouri Botanical Garden, which possesses Engelmann's invaluable collections, concluded the program of the evening with a paper on "Engelmann as a Biologist." He showed a number of drawings which exhibited Engelmann's skill in picturing details of plant structure, among them those made for his thesis, which was published in 1832, as well as the large quarto volume in which his botanical publications were reprinted at the expense of Henry Shaw in 1887, under the editorial direction of the great botanist Asa Gray, of Harvard University. To these were joined specimens of the beautiful prairie flower named *Engelmannia* in his honor, and of the blue spruce of Colorado which also bears his name. Tersely epitomizing Engelmann's work, and analyzing the economy of time and directness of purpose which enabled him to accomplish in the leisure hours of a busy physician's life more than the average achievement of a botanist whose whole effort is directed to his specialty, Mr. Trelease closed by quoting from Engelmann's gifted biographer, Professor Sargent, of Harvard University, the prediction that "the western plains will still be bright with the yellow rays of *Engelmannia*, and that the splendid spruce will still cover with noble forests the highest slopes of the Rocky Mountains, recalling to men, as long as the study of botany will occupy their thought, the memory of a pure, upright, laborious and stimulating life."

At the conclusion of the memorial session, the members and guests of the Academy were invited to pass into another room, where were displayed a number of interesting objects connected with or commemorative of Engelmann's life and work. Under the guidance of Mr. H. C. Irish and Mr. Chas. H. Thompson, who explained the several objects, an interesting half hour was spent in the inspection of this exhibit, which included the manuscript and original sketches for Engelmann's thesis as well as the publication itself in a copy with partly colored plates; several volumes of his many thousands of unpublished notes and sketches; the simple dissecting microscope and the elaborate compound microscope made by Hachet; the jubilee medal struck by the academy in 1906, bearing Engelmann's portrait; an illustration of the Colorado Engelmann spruce; and specimens and original descriptions of the three genera of plants that have been dedicated to his memory in the name *Engelmannia*.

W. E. McCourt,
Recording Secretary